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THE SCOTTISH GEOGRAPHICAL MAGAZINE

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THE SCOTTISH GEOGRAPHICAL MAGAZINE

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ERRATA.

Page 69, line 8 from top, *for vorghum read sorghum.*
,, ,, ,, 13 from top, *for* Bahr-el-Jeleb *read* Bahr-el-Jebel.
,, 72, ,, 23 from bottom, *for* euphorbium *read* euphorbia.
,, 128, ,, 1 of last par., *for* coasted *read* coastal; and on line 4 of next page.
,, 130, ,, 1 of last par., *for* species *read* genera.
,, 134, ,, 2 from bottom, *for* eruptions *read* eruptives.
,, 135, ,, 8 from top, *for* porphyry *read* porphyrite.
,, ,, ,, 12 and line 19 from top, *for* eruptions *read* eruptives.
,, 136, ,, 5 from top, *for* in places *read in situ.*
,, 144, ,, 10 from bottom, *for* Arctic *read* Antarctic.
,, 361, top line, *for* Kushka *read* Kushk.
,, 402 and 409, *for* Zairam-nor *read* Sairam-nor.
,, 486, line 17 from top, *for* Lebarge or Laberge *read* Lebarge or Labarge.
,, 639, in title of article, *for* Anthropological *read* Anthropo-geographical.
,, 646, line 7 from top, *for The Royal Physical Atlas read Bartholomew's Physical Atlas.*

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

THE NEW SEISMOLOGY.[1]

By Professor C. G. KNOTT, D.Sc., F.R.S.E.

To residents in this land an Earthquake is a rare visitant; and when, at uncertain intervals, it does make its presence felt, it is of too mild a type to attract general notice. History, however, is full of records of destructive earthquakes which overwhelm cities, annihilate islands, lay waste broad stretches of country, alter the river courses, and transform the contour of hill and dale. The mind of man, ever prone to dwell upon the terrible and the awful, has seized on this aspect of it; and no poet would ever dream of depicting an earthquake other than a terror that both "wasteth at noonday" and "walketh in darkness." That is the old seismology. That is what we expect to read of in treatises on earthquakes and volcanoes.

But within this generation a new seismology has arisen. The destructive earthquake is no less a terror than of old, but its value as a revealer of scientific truths has grown with the centuries. The gentler earthquakes that spare the works of man are, one might almost say, welcomed by the enthusiasts who make seismology their special study. I recollect once hearing a well-known seismologist remark, when he had got an improved instrument into working order, "Now, if a good earthquake would only come along!" That was in Japan, where hundreds of earthquakes are now registered in the course of each year. And the modern development of seismology is largely due to the workers in that land of seismic activity, and especially to the scientific men from Europe and America whom the Japanese, in their thirst for Western knowledge, so warmly welcomed to their midst. Conspicuous amongst these is

[1] *Seismology*, by Professor J. Milne, F.R.S. (International Scientific Series, vol. lxxxv. Kegan Paul and Co.)

Professor John Milne, F.R.S., whose recent book has brought together, in a form accessible to all, the varied and, to a large extent, novel phenomena that are the basis of what I have called the New Seismology. In Italy also, the same subject has been studied with great eagerness; and in countries like Italy and Japan, where the earth's crust seems to be in a continuous state of commotion, seismological observatories are as necessary as meteorological or magnetic observatories. In our own land, Comrie has long been known as a locality of seismic disturbance; but the disturbances come, comparatively speaking, so seldom that it would require a century to obtain observations of a scientific value at all comparable with what may be obtained in Italy or Japan within a year.

No one of scientific inclination can reside in Japan without being impelled to become, to some extent, a seismologist. As regularly as the stroller in Princes Street looks at his watch when the time-gun fires, so did the resident in Japan draw forth his watch at the first symptom of an earthquake. He timed its advent and noted its longevity. The observation, of course, lacked much of scientific value, there being a large personal equation. Also many a small earthquake that indicated its presence to the dweller in-doors by the creaking of beams and the shaking of ornaments, passed unheeded by the man in the street. Again, alertness in detecting earthquakes varied in individuals, and even a man's position was a factor in his sensitiveness to seismic disturbances. When stretched out on a rattan chair, or when lying in bed, one seemed to be more quickly sensible of the presence of an earthquake, than when walking, or standing, or even sitting—possibly because the body had more points of contact with the earth.

It was, in short, quite impossible for any single observer to hope to catch every earthquake that rumbled past; he might be talking, or hunting, or on a journey, or peradventure he slept too soundly even to be awakened by a fairly severe shock. Hence the necessity for instruments, for self-recording seismographs and seismometers; and once these were fairly established in sufficient numbers throughout the land, personal observations ceased to have the value they once had. Not only did these instruments record, with a precision unattainable otherwise, earthquake shocks that could be felt by man, but they gave records of still feebler tremors whose existence had hitherto escaped detection. On these records of *impalpable* earthquakes, accumulating with a rapidity almost beyond control, the new seismology rests.

The instrument for "forecasting" seismic disturbances has not yet been invented, so that the scientific man cannot hope to vie with the *soi-disant* predicter of earthquakes who claims to know by the "feel" of the air that a shock is near. One night in Japan, when parting with such a prophet, I asked, innocently enough, "Well, is there going to be an earthquake to-night?" He laughed nervously, and then felt obliged to say No. A few hours later we had one of the most lively shocks of the year! The truth is that any nervous person is as likely to feel a little "down" before an earthquake as after it; and when palpable shocks come at the rate of once a week, there is no difficulty in establishing, to

the satisfaction of his prophetic soul, a connection between his nervous state and the earth's seismic state.

In considering briefly some of the old problems that the new seismology has, to some extent, elucidated, and in touching on the new problems that it has conjured up, I do not pretend to discuss necessarily what is of greatest importance in this branch of geological science. The *importance* of a new truth or new fact can be settled only as time goes on; the *interest* of it is largely a personal question. The tiny spark and feeble current which Faraday studied sixty-eight years ago were interesting to the few; nowadays, in telegraphs, telephones, electric lights, dynamos, and motor-cars they are of paramount importance to the world. Naturally, then, I choose for discussion those seismological problems which are, or have been, of special interest to myself. Others will probably find a greater interest in other problems; but all who have any desire to know as much as possible of the pulsations of our earth will find ample material for thought in Professor Milne's new book.

Professor Milne's *Seismology* is an entirely different work from his *Earthquakes*, a fourth edition of which was recently published. It is well to mention this, because a hasty glance at the opening sentence of the preface has led some reviewers to regard *Seismology* as a new edition of *Earthquakes*. To any one acquainted with the earlier work, a very cursory inspection of the new book will suffice to show how different they are. The one, in fact, supplements the other.

In a rapidly progressing science like seismology it is hardly possible for an author of a book to be quite up-to-date; but Professor Milne very nearly manages so to be. On reading the book, one is impressed with the grip the author has of the most recent detailed results from all seismic districts, and with his open-mindedness in accepting observations at their true value, even though these seem to militate against some of his own speculations. Clearly he is actuated by the one desire to arrive at the truth. There is an honesty of endeavour to get at the heart of things. There is no captious criticism of others' work, and no evading of facts which tell against his own views. On the other hand, there is no favouritism to any particular coterie of workers, and there is no mock depreciation of his own work. In singleness of mind Professor Milne sets himself to the task of unravelling a few of the mysteries of earth quiverings. If some of his early theories have proved untenable, he is the first to recognise the fact, and at once begins in the light of growing knowledge to fabricate new ones. For in pioneer work of this kind, a theory is a most fruitful centre of new lines of inquiry. Probably no living man has excelled Professor Milne in the devising and making of experiments which were intended to elucidate seismic phenomena. These are sufficiently referred to in the pages of his book to make their purpose evident.

Perhaps the most startling result of a general character which has been established is that the earth's surface is in a continuous state of movement. The slow secular changes of level have long been familiar to geologists, and these are as characteristic of districts free from volcanic or seismic disturbance as of regions where catastrophes are frequent.

But just as the delicate seismometers, installed in Japan and Italy, proved the existence of veritable earth quakings which were too feeble to assert themselves as "shocks," so still more delicate instruments have brought to light quick tremors, gentle pulsations, and slow tiltings, not merely in so-called earthquake countries, but in every country under the sun. To study these seismic phenomena we need not leave our own shores for any distant isle of the sea. We have simply to establish our observatory far enough away from the rattle of railway trains and the din of traffic, so as to eliminate any artificial source of disturbance, and there with a sufficiently delicate instrument installed—horizontal pendulum, bifilar pendulum, tromometer, etc.—we can study the ceaseless tremblings and pulsations of our earth.

Among the various tremors and shiftings recorded on these delicate instruments, there is one type which the observer soon recognises as having had its origin in a considerable and possibly violent earthquake originating thousands of miles away. In the first edition of his *Earthquakes* (1883), Professor Milne wrote:—"It is not unlikely that every large earthquake might with proper instrumental appliances be recorded at any point on the land surfaces of our globe." But it was not till 1889—six years later—that this remarkable prediction was fulfilled. On April 18th of that year a somewhat curious and uncommon type of earthquake was experienced in Japan. It was my good fortune on the day in question to be engaged in conversation with the late Professor Sekiya in the seismological laboratory of the Tokyo University at the very instant the earthquake occurred. We at once rushed to the room where the self-recording instruments lay, and there, for the first time in our experience, had the delight of viewing the pointers mark their sinuous curves on the revolving plates and cylinders. At first sight it seemed as if the pointers had gone mad, tracing out sinuosities of amplitudes five or six times greater than the greatest that had ever before been recorded in Tokyo. There was not much *sensation* of an earthquake; indeed, after the first slight tremor that attracted our attention, we felt nothing at all, although in the irregular oscillations of the seismograph pointers we had evidence enough that an earthquake was passing.[1]

Now, in March of that year Dr. von Rebeur-Paschwitz (whose early death was a great loss to science) had set up two delicate instruments of the horizontal pendulum pattern at Potsdam and Wilhelmshaven, and these showed on April 18th very singular and similar disturbances. When the accounts of the Japanese earthquake reached Europe, von Rebeur-Paschwitz was struck with its coincidence in time with the perturbations on his horizontal pendulum records. In short, at Potsdam and Wilhelmshaven direct records of a Japanese earthquake were obtained, and thus triumphantly was Milne's prediction of six years before fulfilled. Many like observations have been made since then, wherever sufficiently delicate instruments have been set up. Milne, in his

[1] This account is quoted from a letter I wrote to *Nature* some months later (vol. xli. p. 32).

own seismological observatory at Shide, Isle of Wight, obtains records of distant earthquakes at the average rate of about six per month.

The peculiarity of the record in these cases is that there is a preliminary stage of slight tremors, followed by a much larger and more abrupt motion. The interval between the first tremor and the maximum motion is a perfectly definite interval, depending on the distance the seismic disturbance has travelled. For example, in the record obtained at Potsdam on April 1889, the first tremor occurred thirty-three minutes before the maximum disturbance, and this is the interval which characterises European records of earthquakes that have originated near Japan. Now, on many of the diagrams of palpable earthquakes the record also begins with preliminary tremors; but these last only for a few seconds, and are followed almost immediately by the heavy disturbance. As recorded on the Tokyo seismographs, the earthquake just referred to began thirteen minutes before the instant at which the first tracings appeared on the Potsdam horizontal pendulum record, and lasted for ten and a half minutes. The Potsdam disturbance lasted for two and a half hours. The seismograph, with its pointers scratching out lines on a smoked glass surface was, of course, as regards sensitiveness, vastly inferior to the horizontal pendulum, whose record was taken photographically. The seismograph would have given no indications at all at Potsdam, and the horizontal pendulum would have been set into wild commotion at Tokyo. After the big motion as recorded in the seismograph had died away, a horizontal pendulum would have continued to register movements for hours. How much sooner the horizontal pendulum would have responded to the coming earthquake is not very certain —possibly a minute or two at the most. But these initial tremors which might have been registered on a delicate instrument installed at Tokyo could hardly be the same tremors which first made themselves felt at Potsdam, fully 5000 miles away. Nor can we suppose the long tail of subsiding tremors to be capable of transmission to a great distance with an intensity sufficient to affect an equally sensitive instrument installed there. Taking all the circumstances into account, we are probably justified in regarding the Potsdam record as produced mainly by disturbances which emanated from the origin simultaneously with the big motions recorded on the Tokyo seismographs.

Now, the distance between Tokyo and Potsdam is 5110 miles measured along the chord, and 5560 miles measured along the arc. Assuming then that the origin of the earthquake was not very far distant from Tokyo, we find that certain tremors started by the earthquake must have travelled at a rate of 400 miles per minute, or nearly seven miles per second; that the vibrations which produced the maximum motion travelled at the rate of 110 miles per minute, or nearly two miles per second; while the most slowly moving disturbances attained an average speed of only 34 miles per minute, or fully half a mile per second.

There is an inherent difficulty in identifying corresponding parts of the records of a disturbance at two widely distant localities. Still we cannot be far wrong in regarding the maximum motions at the two places as originally identical, so that this particular type of disturbance

travels between Japan and Europe at the rate of about two miles per second. Had the horizontal pendulum at Potsdam been of less delicate construction the preliminary tremors might have escaped notice altogether, and it is possible that still feebler tremors belonging to the same disturbance, but too weak for detection, reached Potsdam sooner than those that were actually observed. This consideration shows that a comparison of the times at which a particular earthquake registers its advent at various stations can be of little value unless the recording instruments are of equal delicacy. And even when that has been accomplished there is another difficulty. The first tremors recorded at the various stations are not necessarily identical. The disturbance spreads as it advances, and the energy in unit volume still further decays because of viscosity. Hence the first tremor recorded at a given station will be too weak by the time it reaches a station further removed from the origin to make itself felt there, and the first tremor recorded at this more distant station will in reality correspond not to the first tremor at the nearer station, but to a later and stronger one.

Accurate determinations of speed could be obtained if we were able to follow a particular wave or group of waves from station to station, and this will no doubt be effected when instruments of the same type and delicacy have been installed at a series of stations not too far distant from one another. If, however, the stations are too far apart, it is doubtful if the form of waves of the excessive complexity met with in seismic disturbances will be persistent enough to admit of certain identification.

Clearly, then, there is still a great deal to be done; but from the results already obtained a few interesting conclusions may readily be drawn.

In the first place, it touches on the romantic to be able to study directly the effects of an earthquake 6000 miles away from its origin. And the earthquake need not be a destructive one. The disturbance of April 18, 1889, did no real damage in Japan. The waves were so slow that the pointers of the Ewing's seismograph, whose motions I had the good fortune to observe, swung to and fro through large arcs, greater far than the real to and fro motion of the ground. In fact, they ceased to act normally, but because of the comparatively slow, tilting oscillation they began to swing as pendulums set in motion by a synchronous disturbance. Professor West noticed the water in the artificial pool in his garden rising a few inches first on one side and then on the other, exactly as if the pool were being rocked gently like a photographer's developing dish. So gentle and slow was the earthquake motion that many people were unaware that an earthquake was passing.

Then, in the second place, a seismic disturbance as it travels through the earth spreads out in time, its duration at any locality increasing with the distance travelled. This may partly be explained as due to the generation of secondary waves, *e.g.* at surfaces of discontinuity where the primary wave gets broken up into waves of different type. But this explanation hardly meets all the facts. The evidence rather goes to show that a seismic disturbance is an excessively complex combination of vibrations, oscillations, and abrupt displacements, which pass out from the origin with very different speeds. Consequently the longer the distance

travelled, the more separated in time will the various constituents of the complex motion be. There is distinct indication that the preliminary tremors observed at distant stations precede the main maximum disturbance by an interval which increases with the distance travelled. Also it appears (see Milne's *Seismology*, page 77) that the movements registered at the distant stations, besides being much feebler, are distinctly less rapid than the movements recorded at regions close to the earthquake origin. At first sight it might seem as if the individual waves were themselves drawn out into slower vibrations as they sped along. Such an idea, however, is inconsistent with all we know of the properties of wave motion. The comparative smoothness of the motion at a distant station is probably due to the stifling of the more rapid vibrations in accordance with a principle of which there are many examples in the propagation of periodic changes through a medium. The shorter the wave-length of a particular type of wave motion the quicker the decay, other things being the same. No relation of this character can, of course, be established among waves of different type. Thus, short elastic vibrations travel further and have more persistence than long quasi-elastic vibrations, such as the undulatory motion of the *surface* of the ground near an earthquake origin, a motion probably aided by the action of gravity (*Seismology*, page 90).

Finally, and closely related with this spreading out of the disturbance, there is the question of the various velocities indicated. From the beginning of the first tremor, registered at the distant station, to the end of the disturbance, there is, broadly speaking, a continuous state of motion. The tremors are not of uniform intensity throughout, but show several maxima, and then give place to (or exist with) the larger motion, which tails off into tremors with similar alternations of intensity. From the earliest tremor registered at Potsdam on April 18th, 1889, to the last trace of disturbance on that date, the speeds, varied from nearly seven miles per second to only half a mile per second.

Here, obviously, we are face to face with either distinct types of motion or distinct paths through the earth—or, possibly, with both in combination. The high velocity of seven miles per second seems to demand the assumption of very much larger coefficients of elasticity than we ever meet with when experimenting with the rocky material composing the accessible parts of the earth. There is no doubt, however, that high pressure and high temperature will have some influence on the elastic constants of a given substance; and it is quite possible that at no very great distance below the earth's surface pressure and temperature changes are accompanied by profound changes in various physical properties. This seems to be the simplest explanation of the high velocity attained by the preliminary tremors. Without committing ourselves to any very precise theory, we may regard these preliminary tremors as due to the propagation along the *path of shortest time* of certain elastic vibrations set up by the initial movements at the earthquake focus. These fleetest of elastic vibrations are probably of a condensational character, the velocity of propagation depending chiefly upon the resistance to compression of the material at considerable depths;

and this resistance to compression may very easily undergo great increase under high pressure. For rocky material near the surface of the earth, the average resistance to compression is such that the speed of propagation is about two miles per second, just almost exactly the measured velocity for the large motion in the historic case already cited. This lends some support to Milne's view that the large motion is propagated along the arc. Since the speed depends on the square root of the coefficient of elasticity, it follows that the average resistance to compression of the material along the brachistochronic path is about twelve times greater than the corresponding quantity for the surface matter of the earth. The resistance to compression of wrought iron is about five times the resistance to compression of the rocks experimented with by Gray and Milne; so that, due regard being paid to the different conditions as to temperature and pressure, there is nothing extravagant in the conclusion come to.

It is impossible to determine the exact position of the brachistochronic path joining two given surface stations; but probably it does not deviate much from the path of shortest length, that is, the chord. Assuming that it is the chord, then we may make some endeavour to get at the law connecting average speed along a chord with the average depth of the chord below the surface. Professor Milne has already made some progress in this inquiry; and in the last British Association Report of the Seismological Committee (which is compiled chiefly by him) some instructive results are given. A few of these I reproduce here, with the trifling change of kilomètres into miles. These results have been deduced as averages from a great many distinct observations; and the accompanying tables give the speeds of propagation of the Preliminary Tremors and of the Large Waves between stations distant from one another 20°, 60°, 80°, and 110° of arc. The lengths are in miles, the speeds in miles per second.

PROPAGATION OF PRELIMINARY TREMORS.

Degrees of Arc.	Length of Arc.	Length of Chord.	Average Depth of Chord.	Average Speed along Arc.	Average Speed along Chord.	Duration in Minutes.
20°	1380	1370	42	1·7	1·7	0 to 4
60°	4140	3960	378	3·7	3·5	20
80°	5520	5080	655	5·1	4·7	30 to 34
110°	7590	6470	1230	6·8	5·8	41 to 43

PROPAGATION OF LARGE WAVES.

Degrees of Arc.	Average Speed along Arc.	Average Speed along Chord.
20°	1·3	1·3
60°	1·75	1·7
80°	1·8	1·7
110°	2·05	1·75

The numbers in the column headed "duration in minutes" give the intervals for the various distances between the first tremor and the large wave. A careful comparison of these "durations" seems to dispose at once of the hypothesis that the path of shortest time for the preliminary tremors lies near the surface, that is, along the arc. For if that were so we should expect to find some simple relation between the differences of lengths of arc and the corresponding differences of durations. But, as will be seen at a glance, the preliminary tremors take 12 ± 2 minutes to pass over 20° (60 to 80) and 10 ± 3 minutes to pass over 30° (80 to 110); and there is no reason why the tremors, if they are being transmitted through surface rocks, should pass over 30° in about the same time as over 20°.

Let us suppose, then, that the brachistochronic path corresponds approximately with the chord, so that the longer the arc the deeper below the surface lies the course of the tremor. Now, in all cases of transmission of elastic vibrations the square of the speed varies directly as the coefficient of elasticity involved and inversely as the density. The density no doubt increases with the depth, and a greater density means a smaller speed. Consequently, to account for the greater speed along the longer chord, we must assume that the coefficient of elasticity increases very markedly with the depth. To bring out the relation let us square the speeds along the chord and set them alongside the corresponding average depths of chord as in the following table :—

Average depth, . .	42	378	655	1230
Square of speed, . .	2·9	12·7	22·1	33·6

If we plot these numbers one against the other on section paper we find that they lie approximately on a straight line. Let us assume that the square of the speed (v^2) is expressible linearly in terms of the average depth of chord d, thus :—

$$v^2 = V^2 + kd$$

where V is the speed at the surface, and k a constant measuring the rate at which v^2 increases with the depth. Then, applying the method of least squares to the tabulated numbers, we get $V^2 = 2{\cdot}9$ and $k = {\cdot}026$, so that finally

$$v^2 = 2{\cdot}9 + {\cdot}026d.$$

Using the values of d in the table, we find for the calculated values of v^2 the numbers :—

4 12·7 19·9 34·9

which, under the circumstances, are in fairly satisfactory agreement with the actual values.

For considerable depths the second term of the formula becomes of comparatively small importance, so that as the depth increases the formula I have given approximates to Milne's statement that the speed varies as the square root of the average depth.

In this investigation there is one step that is not above criticism; but until more observations are to hand it would be waste of labour to attempt to get a truer estimate of the average speed along a chord. Milne uses what he calls the "average depth" of chord; and I have simply taken his numbers in the calculation just made. But, guided by the approximate result obtained above, we should work out *ab initio* the brachistochronic problem: to find the path of shortest time between two given points on the earth's surface, assuming the square of the speed to be a linear function of the depth.

The conclusion arrived at is, however, of great interest. It means that the square of the speed increases at a rate of nearly 1 per cent. (more accurately 0·9 per cent.) per mile of descent into the earth. Now the square of the speed is measured by the ratio of the coefficient of elasticity to the density. If we assume the density to increase steadily from its surface value we find, in order that the mean density may be $5\frac{1}{2}$ times that of water, that this rate of increase is about $\frac{1}{360}$th per mile descent, that is, 0·28 per cent. Hence the coefficient of elasticity which determines the transmission of the preliminary tremors increases at the rate of nearly 1·2 per cent. per mile descent.

I chose originally the particular law of density made use of here simply because of its adaptability to calculation; but for moderate depths, say to 1200 miles, the densities measured according to the formula

$$\text{density} = 2{\cdot}75 + {\cdot}0028 \times \text{depth in miles.}$$

agree to the second significant figure with the densities according to Laplace's historic but less convenient formula. At 2000 miles depth the two formulæ give almost exactly the same value. At greater depths the values diverge considerably, the Laplace value being the smaller. These relations may be easily shown by developing Laplace's formula in ascending powers of the depth.

Turning now to the propagation of the large waves, we notice that there is nothing like the same increase of speed, as the arc is taken larger. There seems, however, to be no sufficient reason for the speed, as measured along the arc, to increase even at the rate indicated. The results tell rather in favour of the view that here also we are dealing with brachistochronic paths coinciding more or less approximately with the chord. The very slow increase of speed along the chord, as the chord is taken longer and therefore deeper, shows that the coefficient of elasticity, which determines the propagation of the large waves, increases comparatively slowly with the depth—in fact, only at a slightly greater rate than the density. This need in no way surprise us; for the great difference in the rates of propagation of the preliminary tremors and the large waves demonstrates clearly enough that different coefficients of elasticity are involved. The usual view is that the preliminary tremors correspond to what would be called compressional waves in an isotropic solid; and the large waves to distortional waves. The coefficient which determines the speed of the compressional wave involves both the elastic constants—namely, the resistance to compression and the resistance to distortion; the coefficient for the distortional wave involves only the

latter. Now, it is quite conceivable that an increase of pressure may influence the resistance to compression to a marked degree, and yet have a comparatively slight effect on the resistance to distortion. That this really is so seems to me to be almost demonstrated by the seismological facts we have been considering.

Since the values of the large waves' velocities are but slightly influenced by change in average depth, it follows that the path of shortest time coincides very closely with the path of shortest distance. The divergence of the brachistochronic path from the chord will be much more pronounced in the case of the preliminary tremors.

There is no doubt that an earthquake is the source of different types of motion or disturbance, each type travelling outwards as a succession of waves. For simplicity, suppose that each wave of disturbance starts as a sphere. Then, so far at least as the preliminary tremors are concerned, this originally spherical wave-front extends most quickly in the direction of the earth's centre, and most slowly in the opposite direction. Each part of the wave-front advances with a speed which is determined by its depth below the surface. The originally spherical wave-front becomes an oval drawn out in the direction of the earth's centre. A figure showing roughly the forms and distribution of the successive positions of the wave-front is given on page 123 of *Seismology*, where Dr. A. Schmidt's views are discussed. The *paths* of the vibrations are orthogonal trajectories to these wave-front surfaces—that is, they cut the successive "coseismal" or isochronous surfaces everywhere at right angles. These paths are not in general straight, just as, because of varying refraction, the rays that come to us from the setting sun are not straight.

Having in some detail discussed one of the new problems opened up by the new seismology, let us glance very briefly at one of the old problems. I refer to the question of seismic frequency and periodicity (chapter ix. in Milne's *Seismology*). The annual and semi-annual periods, which Mérian, Perrey, and Mallet recognised in the early half of the century, have been fully established by more recent investigators working with infinitely fuller statistics. The time is not yet come for anything like a complete discussion of instrumental observations; but in a catalogue of nearly 9000 shocks, which occurred in Japan during eight years, Professor Milne gave us material which might profitably be discussed in relation to probable or possible periodicities. The peculiar merits of this catalogue were manifold. The time, locality, and area of disturbance of each shock were given: after-shocks of large earthquakes were carefully distinguished from independent shocks; and the earthquakes were grouped according to *district*—a very important classification. There never had been presented to the investigator such a mass of statistics for a limited region of the earth's surface in a form so convenient for discussion. When we wish to inquire into the existence of possible short periods, we should confine our attention to as limited a region as possible, consistent with a large enough body of statistics. As clearly shown by Professor Schuster[1] in his criticism of my own paper,[2] which was based

[1] *Proc. Roy. Soc.*, lxi., 1897. [2] *Proc. Roy. Soc.*, lx., 1897.

on Milne's Catalogue, the total number of earthquakes was not after all sufficient to warrant any very definite conclusion being drawn. The statistics I treated harmonically to find if there was any evidence of periodicities depending on daily and monthly changes in the moon's position relatively to the earth. Any evidence in favour of the existence of such periodicities was no doubt slight, and, according to Schuster, no more than the theory of probabilities might lead us to expect if any statistics whatever were treated in the same way. While admitting the general validity of Schuster's criticism, I still think that in regard to the lunar monthly periodicities the relative prominence of the fortnightly amplitudes merits some consideration—especially in the case of the synodic month. That is to say, there is some evidence of a tendency to increased frequency of earthquakes at times of new moon and full moon. There is no doubt of the existence of lunar tidal stresses within the earth; and we might naturally expect a seismically sensitive region to respond more quickly when these stresses were at a maximum. Not, however, till a much greater body of statistics for one limited region is to hand will it be worth any one's labour to inquire again into the question. All we can say is that lunar stresses, as factors in determining earthquake frequency, are comparatively insignificant.

The old view that earthquakes were more frequent during night than during day was a conclusion based upon incomplete statistics. Instrumental records show an increased frequency, sometimes in the day-shocks, sometimes in the night-shocks—the preponderance in either interval varying in different periods. Before the construction of self-recording instruments, earthquakes were *felt* more frequently during the night, not because they were more frequent, but because their presence was more readily recognised. A careful tabulation of a sufficient body of statistics has however demonstrated the existence of a periodicity in earthquake frequency isochronous with the alternation of night and day. The times of maximum and minimum vary from month to month; so that unless the earthquakes are tabulated by months as well as by hours the effect will be masked altogether. Thus the maximum frequency occurs at midnight in January, but gradually gets later as the year passes on till it occurs at noon in July. From July to December, on the other hand, the time of maximum frequency gradually gets earlier. Milne, Omori, and Davison have all worked at this subject, Davison's harmonic analysis of the statistics being of special interest.[1] The diurnal period in after-shocks of large earthquakes is particularly well shown. There is, however, this peculiarity in regard to Japanese earthquakes and after-shocks. The after-shocks show a diurnal period with a marked maximum a few hours after midnight, whereas ordinary earthquakes, which are not after-shocks, have their maximum falling between 10 A.M. and noon. It is difficult to explain these apparent discrepancies. Wind velocity and changes of barometric pressure have been invoked, but it cannot be said with much success. One interesting point in regard to the effect of high winds was brought out very clearly by Milne, who found that

[1] See *Philosophical Magazine*, December 1896.

tremors got specially lively in Tokyo when high winds were blowing on the other side of the mountain ranges to the west. Such observations show the necessity of taking into consideration the meteorological phenomena over a wide area surrounding a given seismic district.

A very interesting chapter in Milne's *Seismology* is the one headed "Slow Changes in the Vertical." This question is of paramount importance to astronomers, who must look carefully to possible small changes in the position of the piers supporting their instruments. Such fluctuating changes are observed at all astronomical observatories, and have been ascribed to various causes, such as unequal change of temperature, rise and fall of the tide, removal of load on one side by drying of the soil, slight shiftings or bendings of strata, barometric fluctuations, and so on.

Thus it will be seen that the seismologist, in his study of earth shakings, touches hands with the astronomer, the meteorologist, the elastician, the geologist; and in other directions he meets the engineer and the building constructor. The new seismology is a science still in its infancy, but already it has effected considerable progress. Milne's form of horizontal pendulum is being adopted in various parts of the world; and every year is adding to the number of stations and to the statistics that are being compiled. Professor Milne's book brings the subject very nearly up to date; how far it falls short may be determined by a comparison of its pages with the last British Association Report of the Seismological Committee.

THE TRADE OF CENTRAL AND SOUTHERN CHINA.

THE great river of Central China, the Yangtze-kiang, rises in Northern Tibet, in the Tangla mountains, where Rockhill in 1892 saw the rivulets which descend to form the Murui-usu, the chief headwater of the river, in lat. 33° 45′ N. and long. 90° 50′ E. Flowing through Eastern Tibet under the name of Chin-sha, it assumes various names as it passes through Sze-chuan and Hu-pei, and is known to the Chinese as the Yangtze only for 200 miles from its mouth. It drains an area of over 650,000 square miles, the greater part of which lies within the Chinese boundary, and is accessible through the numerous tributaries of the river, which in some cases also afford means of transporting goods into the basin of the Si-kiang.

It is in this part of China that British trade has the best openings—a concession has lately been granted to a British syndicate for mining and the construction of railways in the Yangtze basin—and therefore inquiries into the capacities of the country have been actively prosecuted, and several consular reports have recently appeared. Among these is one by Mr. F. S. Bourne, who accompanied the commercial mission sent out by the Blackburn Chamber of Commerce,[1] from which the following notes are mostly taken.

[1] *Trade of Central and Southern China*, Foreign Office, No. 458.

A great hindrance to trade is *likin*, the internal dues imposed by the Pekin Government after the Taiping rebellion (1850) on goods in transit. Likin barriers seemed to be established at the will of the provincial governors, and even where the amount of the tax is not onerous, the delays and uncertainty as to the sum that will actually be demanded tend to discourage commerce. As an instance, it may be mentioned that there are twelve barriers between Chin-kiang and Huai-an-kuan, about 130 miles to the north, and thirty-six customs and likin barriers on the Grand Canal between Chin-kiang and Chi-ning-chau. By the treaty of 1858 British subjects have the option of sending goods up the country with a transit pass, on payment of half the import dues (2½ per cent.), but, owing no doubt to monopolies maintained by those interested in the likin receipts, the system does not always work well.

In grey and white shirtings, which are the staple of the British import trade, this country has no direct competitor, but Japanese figured fabrics and goods woven at home from Japanese, Indian, and Chinese yarn tend to displace them. The coarse cotton yarn of Lancashire is making place for yarn from India, Japan, and China. To compete with Japan, British manufacturers should adopt Eastern designs and constant changes of pattern.

About twenty-five years ago the importation of foreign yarn led to the weaving of cheaper cloth, which is displacing the native home-spun, and when foreigners by the treaty of Shimonoseki (1875) obtained the right to manufacture in China, four foreign-owned mills were erected in Shanghai, and by the end of 1878 there were probably 500,000 spindles running in China. No doubt the native yarn will in time reduce the foreign import, but not yet. If the country were opened up by the abolition or systemisation of inland taxation, its capacity for the absorption of cotton yarn would be enormous. The finer goods will always command a sale among the wealthier Chinese.

In the Yangtze valley there is a very favourable opening for the manufacturing industry under European control. The working men are patient and persevering, excel in lightness and deftness of hand, and exhibit great powers of endurance. Wages must long remain low, for there is dreadful poverty among the masses, due to rapid increase of population, wherever a district has been for a few decades exempt from famine and rebellion. In the lower Yangtze valley coal and iron are within easy reach, the climate is temperate, and there are abundant means of communication by water.

The Lower Yangtze.

Shanghai is the great emporium for foreign goods in transit to the interior of China lying north of 25° N. lat. It has every facility for the landing of goods, and wharves with an aggregate length of four or five miles, so that a vessel can discharge 1700 tons of cargo, reload and get away within twenty-four hours. It is also situated near the mouth of the Yangtze-kiang, which has a navigable length of 1550 miles, up to Ping-shan, and is joined by many navigable tributaries and canals.

Chin-kiang, situated at the junction of the Grand Canal with the Yangtze, offers great prospects for foreign trade. It contains a "Concession," that is, a piece of ground leased to the British Government and sublet to Western merchants. However, besides the likin barriers, the trade, which chiefly takes a northerly direction, is hampered by a regulation forbidding steam launches and tugs to ply, so that boats often lie for days at Kua-chau waiting for a favourable wind to cross the river, which is here over a mile wide, and enter the canal.

Kiu-kiang is the port for the Poyang lake and the rivers running into it from the province of Kiang-si, and its trade might be much increased by the use of light-draught steamers. To Nan-chang-fu there are 2 feet 6 inches of water all the year round, and over a foot at the lowest thence to Chi-an-fu. By a stream on the east of the lake, which has never less than 3 feet 6 inches of water, Jao-chau-fu may be reached, and by this route the products of the celebrated potteries of Cheng-te-chen are brought down to Kiu-kiang.

A still more important centre is Han-kau. Thence goods are forwarded north-west to the provinces of Hu-pei, Shen-si, Kan-su, and on to Kashgaria; and south-westwards to Hu-nan and Kwei-chau. The former route follows the Han river for 500 miles, up to Lao-ho-kon, in lat. 32° 25′ N., long. 111° 45′ E., where the river is 4 feet deep in summer and 2 in winter. Here the goods are transferred to smaller vessels, in which they are carried to Lung-chu-chai (lat. 33° 45′), and then by a land journey of a hundred miles on pack animals reach Si-ngan-fu. This north-western trade is the most important in Han-kau, but little is known about it, all the transactions being in the hands of Si-ngan-fu merchants. The exports are furs, carpets, wool felt, and native woollens; and the imports foreign goods and native home-spuns. Small steamers might ply with advantage up to Lao-ho-kon, to which place the journey by native boats often occupies four to five weeks.

The foreign trade to Hu-nan is still more important, and the transit pass system runs smoothly. Western Hu-nan and eastern Kwei-chau are supplied by way of the Tong-tung lake and the Yuan river, the navigation of which is often difficult and dangerous; but the main artery is the Hsiang river. It was by this river that Dr. Dickson reached Han-kau in 1861, having come up the north river from Canton and crossed the Tai-meiling pass. This journey he described in the *Magazine*, vol. vi., where he mentioned (p. 401) that native maps showed a connection between the waters of the Hsiang and those of the Kwei-kiang. Mr. Bourne shows here on his map a canal, but does not mention it in the text. Hu-nan is rich in minerals, coal and iron being widely distributed in the Hsiang basin, and when the mines are worked by modern methods, this region may become the richest in China, and hence the demand for the better class of textiles will considerably increase. Boats drawing 3 feet of water can reach Hsiang-tan at all seasons, and a large business could be done by light-draught steamers.

The trade of Han-kau is in the hands of native merchants, who have driven out British firms. The Chinaman lives more cheaply than the representative of a British firm, and the advantage the latter derived

from the exclusive right to a transit pass was removed by the Che-fu Convention in 1876, which gave the same privilege to Chinese.

Sha-si has just been opened to foreign trade, but its capabilities cannot at present be estimated. It is the centre of the greatest weaving district in China, and its cloth is transported to every village of Sze-chuan and Yunnan.

At Ichang the river becomes much narrower, and the alluvial plain which extends with little interruption all the way from Shanghai, here gives place to hills of conglomerate or limestone. The town is only of importance as a place of transhipment of goods from steamer to boat, and repacking into smaller parcels. The distance thence to Chung-king is 500 miles; for 100 miles above Ichang extend the famous gorges, and rapids occur here and there along the whole distance. The Yangtze at Chung-king, above its junction with the Kia-ling, is 300 yards wide, with an average depth of thirty feet, and an average current of three knots at its winter level. In summer it rises ninety feet higher, expands to a breadth of 630 yards, and attains a velocity of some five or six knots. The fall between Chung-king and Ichang is about a foot per mile, and the rapids seem to be due not so much to difference of level as to masses of *débris* brought down by torrents from the mountains and thrown across the bed of the river. In September 1896 a new rapid, the Hsin-tan of Sze-chuan (there is another Hsin-tan or New Rapid lower down in Hu-pei) was formed by a landslip, which narrowed the river bed from about 400 to 150 yards, and increased the fall to about ten feet in 100 yards. Boats have to be unloaded before ascending, and many have foundered in the passage and their crews been drowned.

Mr. Archibald Little, who has for many years been struggling against Chinese bureaucracy to get a steamer up to Chung-king, describes, in his new edition of *Through the Yangtze Gorges*, the voyage in the spring of 1898 of a steamer he had built as soon as Chung-king was opened to foreign trade. The enterprise was successful, though trackers were necessary not only at the New Rapid of Sze-chuan, which has been widened since the catastrophe, but at one or two others also; nor did the vessel get through without injury. This experience seems, however, to show that more powerful steamers may, when the New Rapid has been further improved, and the channel is better known, pass up without great difficulty. Meanwhile the traffic is carried on by junks, and the cost of hauling through the rapids raises the freight between Ichang and Chung-king to 63s. 3d. per ton.

SZE-CHUAN.

At Wan-hsien the barren mountains are left behind, and the great basin of Sze-chuan is entered, one of the richest regions in the world in minerals and the productiveness of its soil. Wan-hsien is a manufacturing town, where raw cotton is spun by hand, and Indian yarn is woven into cloth. There is an overland route thence to Cheng-tu, but Lancashire goods go by way of the Chia-ting river or overland from Chung-king.

This town, built on a peninsula of sandstone hills, lying between the Yangtze and its northern tributary, the Kia-ling, is the wholesale market for the province. The exports are chiefly raw or half-manufactured—such as opium, salt, drugs, and raw silk; the imports are raw cotton, native cotton cloth and foreign goods, including Lancashire cottons and Indian yarn. The value of the exports is about £3,300,000 annually. The trade is hampered by numerous discounts, and the difference in the standard weight and fineness of silver in Shanghai and Chung-king.

The country north of Chung-king along the Kia-ling river is an endless succession of rounded hills of soft red sandstone, and at intervals of twenty miles between Chung-king and Ho-chau run three ranges of mountains 1000 to 2000 feet in height, where iron, coal, and lime are mined. The whole surface of the country is most carefully irrigated and cultivated, and in January was planted with beans, peas, rape, vegetables, and opium. At Ho-chau the Fu river unites with the Kia-ling, and these rivers constitute an admirable system of waterways for traffic, though the upper courses are obstructed by rapids, and consequently Ho-chau is a very prosperous little place.

Mr. Bourne and his companions followed the Fu river through Ta-ho-pa, where the sandstone gives place to shale and the country becomes more or less flat, and after crossing a region of poorer soil, came to the town of Sui-ning in the midst of a rich alluvial plain. Junks of eighty tons can pass up to this town, which is a great centre for cotton-weaving and for the distribution of cotton goods, both native and imported. The introduction of Indian cotton is driving cotton out of cultivation on this plain, as cotton can be grown much more cheaply in India. Its place is being taken by tobacco, indigo, millet, and sweet potatoes. Between Sui-ning and Tung-chuan brine is drawn up from a depth of 100 to 200 feet by means of light bamboo wheels. At the latter town, situated on a fine open plain, silk-growing is the principal industry, and about £29,000 worth of raw silk is exported annually to Shanghai, and as much to Cheng-tu. Fifty miles west of Tung-chuan begins the gentle ascent to the Shan Wang Miao, 2750 feet high, the pass leading into the basin of the Chung-kiang and to the plain of Cheng-tu.

The upper part of the Kia-ling river and the northern frontier of Sze-chuan is described by Mr. G. J. L. Litton, who travelled there in 1897.[1] In most towns great poverty prevails, the soil being poor, and the people lacking in energy. Pao-ning is somewhat better off, commerce being kept alive by the silk industry, a flourishing coal trade on the Tung river, and several small industries.

The country east of the Kia-ling, up to Pao-ning, suffered much from famine in the spring and summer of 1897. For this Mr. Litton assigns several causes: one is the excessive planting of opium, and another the practice of paying rent in rice, which induces the tenant to plant only sufficient to feed himself and pay his rent, devoting most of his land to tobacco, opium, and other crops, of which he retains the

[1] *China*, No. 457. Foreign Office, 1898.

whole profit. In times of scarcity the landlords keep back their stores of rice from the market in hope of getting higher prices. Perhaps the most effective cause of the poverty of a large part of the people of Sze-chuan is the rapid increase of the population, which is probably double what it was in 1812, when Williams estimated it at 21,500,000.

Behind Pao-ning lie a series of low ranges of hills branching off from the central range which divides Sze-chuan from Kan-su and Hu-pei, and running down to the Yangtze at Kwei-fu. The north road mounts the hills and keeps along a high barren ridge, gradually rising to a height of 3670 feet, and soon after drops down into the upper Kia-ling valley at Kuang-yuen. In this district maize is the chief article of food. The main road from Cheng-tu to Shen-si, Kan-su, and Pekin passes the town, and boats bring up salt from Nan-pu, and take coal down; while smaller vessels bring Kan-su tobacco, medicines, sheep-skins, and furs for Chung-king from the flourishing little mart of Pai-shui-chiang over the Kan-su border, whence a high road leads to Chin-chau and Lan-chau, the capital of Kan-su. The chief article of commerce on this route is the Lan-chau tobacco, which is smoked in water-pipes, and is an absolute necessity to the better class Sze-chuanese.

One hundred and fifty miles from Kuang-yuen, up the Pi-kou river, which unites with the Kia-ling at Chao-hua-hsien a little below Kuang-yuen, is the town of Pi-kou, surrounded by mountains rising 2000 to 3000 feet above the river. It is an important outlet for the Chinese drug trade, being at the junction of the mountain tracks from Kai-chau on the north, and Nan-ping on the west. Kan-su is regarded as one of the poorest provinces of the Empire, but its southern portion, if immigration were encouraged, would produce far larger quantities of wheat, hides, skins, and medicines, and take more native cloth and indigo. The trade now suffers from the hindrances caused by the collection of likin, want of good roads and capital, and the insecurity of the frontier.

From Pi-kou the Chung-pa mule-track runs south-westwards, crossing the central mountain range by the Ta-tao-ling, a pass 6150 feet high, and descends to the valley of the Fu river, through orchards of pears, persimmons, and walnuts. In this valley is situated Lung-an, one of the outlets of the great mountain system which occupies the north-western corner of Sze-chuan. The region bounded on the north by the Lung-an-Sung-pan road, on the west by the Min river, on the east by the Fu, and on the south by the Cheng-tu plain, has an area of 3500 square miles, and, with the exception of a small tract round Sung-pan, is inhabited by Chinese or by Man-tsu who have adopted the Chinese language and customs. It is occupied by mountain spurs radiating from the great Pao-hsueh-shan, near Sung-pan, the snowfields of which feed the Fu river. Medicines, musk, and lacquer are brought down by the hill people to the settlements on the Sung-pan road, and wine, grain, and meat to the Chinese inhabitants of Sung-pan.

The scenery on the way to Sung-pan is remarkably fine, the road plunging into the limestone gorges of the Fu river, overlooked by precipitous mountains on either side. The road is unusually good for such a remote region, and though the head of the pass to Sung-pan lies

10,000 feet above Lung-an, there is no steep hill the whole way. As the pass is approached some very fine virgin forests are passed, rising to a height of 11,000 feet above sea-level. The pass itself, 13,000 feet high, is a picture of desolation, and is a place much dreaded by the Chinese, the more so because of the distressing mountain sickness, which they can only ascribe to demons. On the western side the forest has been entirely cleared away by the tribesmen. Fifteen hundred feet below the top of the pass are many prosperous Hsi-fan Chai-tsu villages, and the hill-sides are thickly cultivated with barley.

Sung-pan, at the head of the Min river, surrounded by bare mountains, enjoys a clear, bracing air, and a plentiful supply of good beef and mutton, bread, butter, and milk; and the interest attached to the various tribes that crowd the streets, and the important commerce that is transacted here, render the town the most fascinating in Sze-chuan. In the autumn the temperature ranges from 46 to 56 degrees, while in winter the thermometer falls to zero. Here trade is in the hands of about twenty large firms, chiefly agents of Cheng-tu and Chung-king houses, but the most important shops are those of the four Government tea monopolists, managed by Mohammedans from Si-ngan, who also do a large general business. At least half the inhabitants are Mohammedans. The tea which is supplied to the tribes in the neighbourhood comes partly from the mountains north of the Cheng-tu plain, and partly from Kuan-hsien, and is of very coarse quality. The Mohammedan merchants extend their commercial relations to Tao-chau, and even as far as Koko-nor, a journey of five weeks for a laden animal. Their assistants travel in the grass country of Amdo, taking tea, foreign cottons and cloth, iron and brass wares and silver, and bringing back musk, rhubarb, deers' horns, skins, and wool. The last comes down to Sung-pan in long ropes, and in a very filthy condition, and is thence forwarded on mules to Kuan-hsien, where it is loaded on boats. The trade is a new one, and seems capable of indefinite extension. Twenty thousand to twenty-five thousand live sheep also are driven down annually to the Cheng-tu plain.

The likin has become a serious burden to the Sung-pan trade. A merchant sending goods to Shanghai through Mao-chau must pay likin at seven different barriers, or if he sends it by the rather more expensive route through Chung-pa, at five barriers. The discontent is caused not so much by the amount of the tax as by its tendency, under the late Viceroy Lu, to increase in amount, and by the frequent addition of new collecting stations, as well as by the misconduct of the underlings in charge of the stations. Another inconvenience is the state of the currency. Copper cash, of which about thirty are equivalent to a penny, is a very bulky form of currency, and hence their value in silver differs often considerably at places not very far distant, the cost of carriage blocking the flow. The quantity of cash also is insufficient, and hence spurious cash have come into circulation, causing endless worry and bargaining.

The route from Sung-pan to Mao-chau runs along the Min river through very grand scenery. East of Mao-chau an easy pass, 6200 feet

high, leads to the source of the Shi-tsuen river, and down to the town of Chung-pa, on the Fu river, one of the most important marts in north Sze-chuan. It owes its importance to its position on the plain at the junction of routes from Sung-pan, Pi-kou, Shi-tsuen, and other smaller places, and at the head of navigation from Chung-king. It is also the centre of a large agricultural district, rich and densely populated, which absorbs large quantities of salt, native cloth and yarns, and produces indigo and aconite, the latter a very popular medicine for old men. Mien-chau, thirty-five miles down the river, is a silk emporium, and has a considerable cotton-weaving industry. There is a large display of foreign yarns in the shops, and of foreign goods in general. The high road from Pekin to Cheng-tu passes through the town. On the way to Cheng-tu lie Te-yang-hsien, surrounded by large sugar plantations, and Han-chau (45,000 inhabitants), with a great sugar and tobacco trade. Hsin-tu-hsien, twelve miles from the north gate of Cheng-tu, is also a busy place.

The Cheng-tu plain, which strikes all travellers by its extraordinary fertility, is separated from the basin of the Fu river by a ridge which, on the Pekin road, rises only 200 feet above the plain, but becomes a considerable range farther south. The plain rises gradually towards the north and north-west, Kuan-hsien, forty miles north-west of Cheng-tu, being 700 feet above the latter city. South and south-east the low hill country around Chien-chau is reached in a journey of thirty miles, and south-westwards the plain dips down to Chiang-kou, 200 feet below Cheng-tu, where all the branches of the Min river reunite. The area of the plain is about 2500 square miles, and it contains, besides Cheng-tu, with an estimated population of 400,000, fifteen cities, of which two at least, Han-chau and Mien-chau, have a population of not less than 40,000. An extraordinary number of well-built farmhouses, each surrounded with gardens, fruit-trees, and groves of bamboos, gives an air of prosperity to the country such as is rarely seen in China. The chief agricultural products are silk, tobacco, sugar, rapeseed oil, paper, indigo, fine flour and, most important of all, large quantities of rice.

The productiveness of the plain is entirely due to irrigation works, without which the east and west sides would be a marsh, and the north a waterless desert. The most important works are at Kuan-hsien, and are remarkable for their simplicity and ingenuity. The objects of Li Ping, the governor to whom the works are due, were to prevent an excessive rush of water down the west of the plain, and to irrigate the north and centre. At Kuan-hsien the Min issues from a magnificent gorge, and sends off a small branch to the west. Just below the city a copious stream forty yards broad has been diverted eastwards through a channel cut through the solid rock. This stream is again divided into three branches, two of which, after irrigating parts of the plain, meet again at Cheng-tu, while the most northern, after irrigating the northern part of the plain, pours its remaining waters into the Fu river. A movable barrier just below the gorge of the Min renders it possible to exclude the water from the main river and the subsidiary channel alternately, so that the channels can be annually cleaned out.

Mr. Bourne noticed a great display of articles of Chinese luxury in the Cheng-tu shops—gorgeous silk brocades, delicate pongees, and silverware. The navigation, at least in winter, leaves much to be desired, the river being shallow for fourteen miles from Cheng-tu; flat-bottomed skiffs, drawing nine inches of water, are the only craft that can be used on this section. Hills soon appear again, and before Chia-ting is reached the country becomes very beautiful. Chia-ting-fu, at the confluence of the Min and Tung rivers, is a wealthy city, the capital of a rich and lovely country. The district produces the best white silk in China, and in the city plain silk cloth is woven from it. Raw cotton is also woven in the neighbourhood. Tung-ting has a considerable trade along the rivers on the west, on which the goods are conveyed on bamboo rafts, covered over with waterproof. In this way the valley lying north of the great curve of the Yangtze, between Huei-li-chau and Ning-yuan-fu, is supplied with Han-kau cotton cloth and Lancashire goods, but, owing to the likin nuisance, foreign goods are reaching Ning-yuan-fu from Tonking and Mong-tse under transit passes: Burma ought to supply it through Ta-li-fu.

Opposite the city of Chia-ting a huge figure of Maitreya Buddha is carved out of a limestone bluff. Its height cannot be less than 380 feet, the head alone being 30 to 40 feet high, and the nose 4 to 5 feet long. The figure was carved about a thousand years ago.

At Hsu-chau-fu (locally known as Sui-fu) the Min unites with the Chin-sha to form the Yangtze. The Chin-sha is no doubt the larger river, but is of less importance commercially, for navigation practically ceases at Ping-shan, forty miles above Sui-fu, not because of obstacles in the river, but because it runs through a mountain territory occupied by the Lolos, over whom the Chinese have no control. The Lolos are a race akin to the Tibetans, and perhaps the Burmese, who have resisted for nearly two thousand years the attempts of the Chinese to subdue them. They sometimes carry off Chinese into slavery.

The red basin of Sze-chuan, which embraces about two-thirds of the surface of the province, and perhaps nine-tenths of the wealth and population, has an area of about 100,000 square miles, inhabited by forty to fifty million persons. It is drained by a splendid system of rivers, which run in deep valleys so that floods are rare, and which afford easy means of communication. The high returns of agriculture are due more to the climate and cultivation than to richness of soil. The basin is enclosed by mountains on all sides, and clouds cover it throughout the winter, keeping in the heat, so that the thermometer rarely falls below 45° F. at Chung-king. Consequently two, and sometimes three, crops are harvested in the year, at least one crop of rice in summer and one of opium, wheat, beans, rape, etc., in winter. Though not bracing, the climate is healthy, and there is little malaria. Coal, both hard and soft, is found in the mountain ranges, and iron, salt, and petroleum are also extracted: copper, lead, gold, and silver are found on the western border, particularly in the Ning-yuan district. The Yangtze affords the only navigable outlet, and the trade with the districts on the north, west, and south passes along mountain tracks only fit for pack animals and porters. Europeans with

ample capital, residing in Chung-king and engaging in manufacturing industries, could expand the home industries to a large extent, and thus increase the demand for foreign goods.

Yunnan.

The road from Sui-fu to Yunnan skirts the Yangtze for twenty miles to An-pien-chang, a village at the mouth of the Heng river, and then ascends the latter to Heng-chiang, the end of navigation in the direction of Yunnan. It then passes on to Lao-wa-tan, a great likin station, and immediately after begins to ascend the slope of the Yunnan plateau. The road, once neatly paved with stone, is now in many places no better than the bed of a mountain torrent. It is, nevertheless, the only great commercial route between Yunnan and Sze-chuan and the eastern provinces, and a large transit trade passes along it. The red sandstone of Sze-chuan disappears before Lao-wa-tan is reached, and is replaced by blue and grey limestone. The river Heng, running at first in a broad valley, is presently confined to a narrow gorge, and still further up disappears at the end of a *cul de sac*, into which it finds its way down from the plateau by subterranean channels.

The prefecture of Chao-tung is miserably poor. The country lies 7000 feet above sea-level, and the soil is a dry loam; sun and wind prevail from November to June, and from July to October there is too much rain. It may be described in general as a dry, bare, treeless plateau, almost without rivers, and draining into peaty lakes. One of the worst tracts is the descent from Chao-tung-fu to the Niu-lan river, a tributary of the Yangtze. The road is very bad and steep, and except the little town of Chiang-ti, there is scarcely a house for forty-six miles. Water is the great want, and dry, wind-swept downs extend on all sides, except where a small stream enables the natives to irrigate their fields in its narrow valley.

At Tung-chuan-fu, situated in a valley ten miles long by one to three broad, the trade-routes from the Yangtze on the north and from Tonking and the West River meet. There is now little demand for foreign goods in the town itself. Fifty years ago, when mining was carried on with some success, Tung-chuan is said to have been prosperous. Copper is still extracted in considerable quantities at four places within fifty miles of the town, and lead, zinc, silver, and coal occur in the prefecture. Mining, especially of copper, was at one time a great source of profit to the Government, but has fallen into decay, like everything else in China. The Imperial Commissioner for Mines is said to be a particularly honest official, but he is crippled by the want of honest men and money. Thirty miles from Tung-chuan the road to Kung-shan skirts a range of mountains over 10,000 feet above sea-level and capped with snow till June, in which the famous Lo-si copper mines are situated.

From Lao-wa-tan to Kung-shan, 305 miles, the country is of no value for foreign commerce. The people can scarcely afford to pay for sufficient clothing, and what they do wear is made of Sha-si cotton. Were the mineral wealth of the country properly developed, they would be in a very different position.

After Kung-shan fertile vales are traversed, covered with beans and poppies which make a wonderful display of colour in the flowering season, while the hills are clad with pines and flowering shrubs. Unfortunately the poppy monopolises a large proportion of the fertile valleys, and the use of opium shows its effect in the laziness and apathy of the people, who are also not as strong in physique as one would expect in a mountain country. Opium has become almost the medium of exchange, and pays for the goods imported into Yunnan from Sze-chuan and Hong-kong.

At Yang-lin the western road running from Han-kau to Burma is joined. It is twelve feet wide, and paved with irregular blocks of limestone, and was once, no doubt, an excellent road, but is now fallen into a bad condition. Again a belt of poor, though beautiful, country intervenes between Yang-lin and the plain of the Yunnan-fu lake. This plain is about fifty-five miles from north to south by fifteen from east to west, and the greater part of this area is occupied by the lake, which has an outlet to the Yangtze at Ngan-ning-chau, but one not large enough to carry off the rains of July and August when the plain is consequently flooded for miles to the east of the city. On the west a line of bluffs overlooking the lake, from a height of 1200 feet, afford a magnificent panorama. The climate is neither very hot nor cold, but the winter drought and the excessive rains of summer are not favourable to vegetation. The city has walls not more than three miles in circuit, and contains about 100,000 inhabitants.

A large trade must be carried on in cotton, as little else is worn, and no cotton is grown in the province. North Yunnan is supplied with raw cotton from the Yangtze valley, west and central Yunnan from Burma, and the south-west of the province from the Shan States. A large quantity of cloth is woven in Yunnan-fu from imported yarn, and the consumption of native cloth and Sha-si cloth is about the same. The province has been incredibly slow in recovering from the rebellion, and the towns and villages, except Yunnan-fu, look no better than they did ten years ago.

Since 1885 the import trade in foreign goods has almost entirely shifted from the West River route through Po-se-ting to the Mong-tse and Tonking route, owing to the energy with which the French have insisted on their right to transit passes. The Red River trade is almost entirely a transit trade in goods from Hongkong, and therefore British goods can be obtained more cheaply than formerly in Yunnan-fu (though the French discount to a large extent the pecuniary advantages of the route by their imposts), for goods coming into the country on this side have only to pass through the Customs house at Mong-tse, which is managed by the European staff with the utmost fairness and consideration. At present British goods are actually carried from Mong-tse to Yung-chang-fu within seven days' journey of Bhamo, but when the issue of transit passes to Ta-li-fu, Yunnan-fu, and Sumao is demanded, Burma will be able to supply the richest part of Yunnan. Perhaps it will be impossible for the Burman to compete with the Red River route in Yunnan-fu and the country to the south and east of the town, owing to

the long land journey, but there is an alternative route up the West River.

Po-se-ting is the head of navigation on this river. The road to it from Yunnan-fu crosses the plain, and after four miles enters dry yellow downs. Ten miles farther the mountains are reached, and the road ascends and descends heights of 1000 feet, passing a beautiful lake, the Yang-tsung-hai, ten miles long by three broad. On the watershed between the Yangtze and Tonking drainage basins there are no streams, but the water, impregnated with fine red dust, lies here and there in pools. Artesian wells and artificial irrigation would transform the country into a paradise, for there is water at a depth of 20 feet, but now the towns are among the poorest in China. On the farther side the road descends to the Hung-shui-kiang (Red Water river), 40 yards wide and rendered unnavigable by rapids, which is the central and, perhaps, the longest of the streams that combine to form the West River of Canton.

Kwei-chau.

Twenty miles east of the Yunnan border is the large market-town of Hwang-tsao-pa, a busy place in a fertile valley, with an enterprising population, composed chiefly of immigrants from Sze-chuan and Kiang-si. The inhabitants have always been very independent, and during the rebellion prospered exceedingly, keeping peace in their own streets, and selling goods to all who could pay for them; in the present quiet times officials have to be tolerated, but exercise very little authority. Usually goods come up from Po-se and the Si-kiang, or West River, but when Mr. Bourne and his companions arrived, the road was blocked through a disturbance arising from the murder of a French missionary, and goods were being brought in from Han-kau *viâ* Kwei-yang. The trade in foreign goods is not active, the people being homely and seldom needing finer fabrics than they can make themselves.

From Hwang-tsao-pa to Tai-ping-kai the country is typical of the lovely province of Kwei-chau—valleys among limestone hills covered with a profusion of flowering shrubs of the temperate region, particularly roses of all kinds. But from Tai-ping-kai there is a descent, at first gradual and then precipitous, into the cañon of Hwa-kiang, one of the two branches of the Pei-pan-kiang which joins the Hung-shui-kiang of Kwang-si. The road descends 2400 feet, and rises again to the same height within a distance of seven miles. The black gorge, surmounted by the peaks of the bordering ranges, makes an impressive picture of bare mountain scenery. At Hwang-kwo-shu the main road from Han-kau to Burma is joined, and there are some signs of improvement, whereas the villages thus far are all in ruins, having been destroyed in the rebellion.

Ngan-shun-fu is beautifully situated on an undulating plateau between conical limestone hills. Having been the head-quarters of the provincial army, it was not taken by the rebels, though they ravaged the country up to its gates for thirty years. The town is supplied with raw cotton from Han-kau, by the Tung-ting lake and Yuan river route; but a little, grown by Miao-tze, comes from the south of Kwei-hwa-ting, the

only place apparently where cotton is cultivated in Yunnan or Kwei-chau. There is here a fair demand for foreign cotton goods and Indian yarn, which are brought from Hongkong by way of Pakhoi, Nan-ning, and Po-se. If transit passes were exacted, the district might be supplied from the newly opened port of Wu-chau. At Ngan-shun and at Kwei-yang-fu the English travellers saw many parties of Hunanese well armed, who brought up foreign goods from Hong-chau-fu, in Western Hu-nan, to exchange for opium. They are great distributors of British goods, and would carry more if there were an open port in Hu-nan, where they could buy goods covered by transit pass, for in the absence of exchange banks they must carry silver or goods, and would much prefer the latter.

The land is good, but is little cultivated since the rebellion, even near the provincial capital, Kwei-yang. There is a good demand here for British cotton and woollen goods, which come from Han-kau by the Tung-ting lake, and up the Yuan river to Chen-yuan-fu, the head of navigation, and thence on pack animals. From 1886 to 1891 transit passes were respected in the province, but in the latter year the prefect insisted that likin should be paid on all goods, whether a pass had been taken out or not, and consequently the trade in foreign goods has seriously decreased in the city, and in eastern Kwei-chau generally.

From this point Mr. Bourne decided to gain the West River by a route that had not been explored by European travellers, except the French missionary, Père Bodinier, but which seemed deserving of investigation in view of the opening of Wu-chau to foreign trade. It makes for the Ku-chau, and follows this river down to its confluence with the West River at Hsun-chau-fu above Wu-chau. South-east of Kwei-yang nine-tenths of the land lies fallow, only the valley bottoms being cultivated, and enough grain grown to feed the population of each valley, as any surplus could not be got to market. The hills are covered with grass, but there are no sheep or cattle. Tu-yun-fu is in ruins, as it was ten years ago, and the country round it, though fertile, is uncultivated and almost uninhabited. Only good government and capital are needed to totally change its present unfortunate condition, and enable it to support a far larger population. At San-chuo the Ku-chau branch of the West River is reached, and the rest of the journey is accomplished by water. For the first ten miles mountains shut in the river on either hand, and there are rapids every hundred yards. The hills are well wooded and covered with good grass, which might support flocks and herds; but the Chinese are not a pastoral people. Three miles beyond Ping-mei lies the border of Kwang-si.

Kwei-chau is richer in agricultural advantages, and probably in minerals also, than eastern Yunnan. The bed rock is everywhere limestone, making beautiful scenery, and a healthy climate. The altitude sinks from 5000 feet in the west to 1500 feet on the Hu-nan border. The streams do not run in deep gorges as in Yunnan, but in narrow valleys between limestone hills, with sometimes a little terrace cultivation near the water, while the hill-sides are clothed with ferns and flowering shrubs growing in great luxuriance; or, if the valley be at some distance from

a town, it is clothed with firs, bamboos, and fruit-trees, the haunts of pheasants. A great contrast is the state of the inhabitants; their fixed capital—cattle, buildings, and farm implements—were destroyed in the rebellion, and since then they have had no opportunity of saving money to replace them. Colonies of Chinese are said to have been planted in central Kwei-chau in the twelfth century, but they have neither displaced nor assimilated the older races, who still make up, perhaps, half the population. The north-west is largely occupied by Lolos, who have colonised it from their home in the great bend of the Yangtze, and the Shans have come in from the south and west, while the Miao-tze seem to be indigenous. These non-Chinese inhabitants of western Sze-chuan, Yunnan, Kwei-chau, Western Hu-nan, Kwang-si and Kwang-tung are quiet people and excellent farmers, and are by no means savages, though more manly than the Chinese. From a business point of view they are less satisfactory, because they prefer a rustic life and home-spun clothes, whereas the Chinaman will buy luxuries to the full extent of his means.

In no part of the Empire would railways be more advantageous, for there is no water traffic in the province, except on the east, and there it is very difficult. The best line would be through Hu-nan to the Yangtze, the present line of trade. A railway to Nan-ning-fu in Kwang-si would meet with no obstacle, but would probably not pay at present.

Kwei-chau, like Yunnan, can export only goods light in weight in proportion to their value, and therefore her chief export is opium. There are, however, other products which might be turned to good account. The raw silk industry centred at Tsun-i-fu might be greatly developed; the paper mulberry (*Broussonetia papyrifera*) grows all over this province and Kwang-si, and the fibre, which is an excellent material for paper, might easily be brought down to Hongkong; and there are several other natural products, such as camphor, rubber, box-wood, vegetable oils and tallows.

Kwang-si.

At Huai-yuan-hsien, the first district city in Kwang-si, the mountains which thus far accompany the Ku-chau river sink into low hills with valleys in which there is some little cultivation. Above Chang-ngan-su the river is joined by several tributaries, and this place is the limit of regular navigation, boats drawing three feet of water being able to reach it all the year round. As a rule the country, where not hilly, consists of poor dry downs covered with grass, which evidently were once cultivated. Thirty miles below Yung-hsien a rolling plain commences, covered with good grass. At Liu-cheng, a fine tributary joins the stream from the west, which is navigated up to Ching-yuan-fu, where it is eighty yards broad.

Liu-chau-fu is a picturesque city surrounded on three sides by a bend of the river, beyond which, to the south, stretches a grassy plain broken by fantastically-shaped limestone hills. The town was taken by the Tai-ping rebels, but was rebuilt by capital from Canton, and now contains some fine buildings. Most of the trade is in the hands of Cantonese, the natives of Kwang-si being lazy and wanting ambition; they

grow just enough rice to satisfy their needs. The officials are trying to induce them to cultivate the hills with rice, but without much success. Were Kwang-si and southern Kwei-chau properly cultivated, and the rice brought down by the network of streams flowing into the West River, Kwang-tung might be independent of Saigon and the Yangtze for this article of food. Below Liu-chau the river traverses a rolling plain of reddish marl and clay with hills of limestone, typical of Kwang-si generally. Sugar and tobacco are cultivated, but not the poppy, as it is said to yield no juice below the plateau. Below Hsiang-chau the Lung-kiang, 350 yards broad, is joined by the Hung-shui-kiang, usually called on maps the main branch of the West River. It is, however, smaller, only 200 yards across, and is difficult to navigate and little used for traffic. Six miles lower is a very bad rapid, the Lu-tan, which might, however, be easily cleared. At Hsun-chau-fu, the Hsun or Nan-kiang, the West River of Canton, comes in from Po-se and Nan-ning; it is a smaller river than the Liu-fu and must bring down less water.

The mountains now cease, and the river pursues its course through much better country, and as Wu-chau is approached the land is more thoroughly cultivated and large villages and market towns appear. The towns above Wu-chau, and to a large extent Wu-chau itself, are supplied with foreign goods through Pakhoi in consequence of the heavy likin dues on the West River. Now that Wu-chau is opened to foreign trade goods will be imported direct from Hongkong on payment of treaty tariff only, but the merchants expect that the officials will levy the duties after the goods have reached their hands, and evade the transit pass regulations by a differential duty, thus rendering the opening of the port an illusory privilege. Wu-chau, at the junction of the West and North rivers, is closely packed with well-built houses, and it is evidently a prosperous place; there is good anchorage and no obstacle to the navigation of light-draught steamers to Canton and Hongkong.

The western half of Kwang-si is poor and backward, inhabited chiefly by Shans and never effectively occupied by the Chinese: there has always been here a good deal of brigandage and disorder. The eastern half has suffered grievously from the rebellion, but has recovered more quickly than Kwei-chau owing to the enterprise of the Cantonese. Kwang-si generally is thinly peopled and badly cultivated, so that a long period must elapse before it can pay for imports fairly proportionate in quantity to its area. Both Nan-ning and Liu-chau could be reached by steamers, if a small sum were spent in improving the channel. It is difficult to understand how goods could profitably be sent round by Hanoi and Nan-ning, if there were direct steamer communication and the likin nuisance removed.

Besides this hindrance to trade, the British merchant is also at the mercy of the Chinese compradores, who are often in league with the likin officials to control the trade: he might with great advantage transact his inland trade through European employés who could speak Chinese and might reside in the up-country towns so as to gain a knowledge of the people and their requirements. The difficulty of learning the language has been greatly exaggerated. Excepting along the coast between

Shanghai and Canton, one language, the Mandarin, is spoken through the length and breadth of China, with slight variations considering the huge extent of country. A clever, persevering youth could learn enough for the purposes of trade in a year, doing his ordinary work at the same time.

There can, however, under no conditions of trade, be a great development of foreign commerce, unless the home production be enormously increased. In most of the provinces there is neither the capital nor the energy requisite to turn the natural resources of the country to the best account. Now that British subjects have the right to manufacture in China, they have an opportunity of inaugurating a better state of things. The value of Chinese exports, such as silk, wool, hides, furs, paper and tobacco, would be greatly raised by sorting and grading in China. Much is being done in this direction in Shanghai, in silk filatures, for instance, and something in Tien-tsin, Fu-chau and Chin-kiang. The manufacture of those products should also be encouraged in which this country cannot profitably compete. British industry cannot compete in coarse yarn with Japan and India, and the value created in China would enable the Chinese to buy more of the finer goods which they cannot produce themselves.

OBITUARY: 1898.

Sir GEORGE GREY, K.C.B., D.C.L., ETC.—There can be little doubt that at the death of Sir George Grey on the 19th September last, the present generation sincerely mourned the loss of a veteran statesman and experienced pro-consul, and had but little recollection of the fact that he first brought himself into notice as an explorer and geographer. Born in 1812, he joined the army in 1830, and was sent to do duty in the wilds of Connaught. Of this, however, he soon tired, and apparently in 1836 his mind turned to exploration and geographical research. At that time the greater part of the western coast of Australia had been unexplored, and the interior was an absolutely unknown country. On the other hand, there was a very general belief that one, if not more than one, great river would be found to enter the sea on the west. "Anxious to solve this interesting geographical problem," as he himself tells us, the young soldier and his comrade Lushington offered their services to the Colonial Secretary, and proposed to conduct an exploring party from the Swan river northwards. The proposal was accepted, but the route of the expedition was changed, viz., instead of going from south to north, it was to go from north to south, or from Prince Regent's river to the Swan river. On the 2nd December 1837 they landed near Hanover Bay, and soon found themselves in great trouble from the intense heat and from want of water. Here Grey nearly lost his life by drowning, and he was severely wounded in an attack by the natives. In this expedition he discovered a river which he named the Glenelg, the course of which he traced for some distance. After this the expedition returned to the coast, and sailed for the

Mauritius. Undeterred by his previous dangers, and by the very moderate success of his first attempt at exploration, Grey returned to the Swan river and made preparations for another start. A whaler took his party in February 1839 to Sharks Bay, where they landed and commenced exploring the coast, beginning with a river which Grey named the Gascoyne. But in a very short time all their boats were smashed or useless, and when they reached Gantheaume Bay there was nothing for it but to walk back to Perth, a distance supposed to be some three hundred miles. The sufferings of the party during that terrible march must have been great. For days they were without water; food was most scanty; they had good reason to suspect both the knowledge and good faith of their guide, and they were often in great danger from the natives. During this expedition Grey explored the country between Cape Cuvier and the Swan river, and he claimed to have discovered two mountain ranges, one north and east and the other west of the Darling range, and ten large rivers, viz., the Gascoyne, Murchison, Hutt, Bowes, Buller, Chapman, Greenough, Irwin, Arrowsmith, and Smith, and, besides this, he had acquired much new information regarding the natives and the fauna and flora of the district through which he travelled. His work, published in 1841, though now superseded and practically obsolete, is still interesting and a standing monument to his courage, energy, and perseverance in the midst of trials and difficulties which only a born leader of men could surmount. His reputation was now made, and he was soon called on to begin a new career as colonial governor and statesman, in which both friend and foe (for he had many foes) will admit he attained to the highest rank. But his achievements as an explorer and geographer had come to an end.—H. B. F.

Major-General R. G. Woodthorpe, C.B., R.E., who died in Calcutta on 26th May 1898, had during his employment of twenty-seven years in the Survey of India exceptional opportunities of contributing a large amount of new geographical information within and beyond the Indian frontier, and his services both as a geographer and as an explorer merit very special recognition.

His military services with troops in the field, occasioned through his being attached as a survey-officer to armies operating beyond the confines of India, were also eminent, and he received honourable distinction on several occasions on the recommendation of the military authorities.

The Khasia, Garo, and Naga Hills, which border the Assam valley and extend to the north-eastern frontier, were the scene of his first surveys, and there he remained for over seven years, conducting an exhaustive survey where the tribes on the outer ranges of the hills were peaceable, but frequently called away to accompany a military expedition for reconnaisance work, when a disturbed tract had to be visited or retribution exacted for a predatory raid. The rugged ridges and deep, narrow valleys of these hills, all thickly jungle-clad, presented many difficulties for survey work, but these were of little moment to the active and hardy

Woodthorpe. He found much to interest him in the manners of the tribes of that region, still little touched by civilisation, and their ornaments, dress, and weapons afforded many subjects for his ever ready brush and pencil. The military enterprises to which he was attached at this time were the Lushai Expeditionary Force of 1871-72, the Garo Hill Expedition of 1872-73, and the Naga Field Force sent out first in 1875, and again in 1876. On the outbreak of the war with Afghanistan in 1878, his acknowledged skill as a military topographer readily led to his selection as one of the survey officers to accompany the army, and he was attached to the column under General Roberts which advanced on Kabul by the Kuram valley. The exertions required of the surveyors to keep their mapping of the mountainous country abreast of the march of the army were especially arduous, and Woodthorpe was always ready to take his share in the roughest ground and on the highest hills. He was equally prepared when the enemy were encountered to enter the field of action, as an aide-de-camp to the General, and as such by his coolness and bravery he rendered conspicuous service. At the end of this first phase of the Afghan war, Captain Woodthorpe was rewarded for his services by promotion to Major.

On the war being renewed in 1879 after the massacre of Cavagnari and his escort in Kabul, Major Woodthorpe was again sent into the field, and in the operations under General Roberts round Kabul he worked as a surveyor when opportunity offered, or he served in a military capacity as directed by the General. Here he took part in the actions of Peiwar, Alikhel, Kila Karez, Chardeh, Takht-i-Shah, Asmai, and Saidabad. His services then brought him promotion to Lieutenant-Colonel.

The year 1880 saw him back in his old survey field on the hills south of the Assam valley, and he worked there for three seasons.

In 1883 he was attached as military topographer to an expedition against the Aka tribe, to the north of the Assam valley, where he rendered notable services, which were handsomely acknowledged by the general officer in command. In the following cold season of 1884-85 he was employed on an important exploration of the unknown country between the eastern limits of the Assam valley and the upper waters of the nearest tributary of the Irrawadi river in Burma. The object in view was successfully accomplished, and the party returned to Assam, after having endured many privations and hardships. By this journey a certain doubt was cleared up as to the source of the western branch of the Irrawadi. After return from this arduous exploration, little rest was allowed to Colonel Woodthorpe. He was very soon called upon to join a mission which was being despatched under Colonel (now Sir William) Lockhart to the north-west frontier of India, to establish friendly relations with the petty chieftains whose territories lie between Kashmir, the Pamirs, and Badakshan, and to examine the passes leading from these territories into India. The information gained, both as regards the temper of the people and the character of the passes, was most valuable at the time, but the country has since become better known through the operations of one of the Russo-Afghan Boundary Commissions, and through the occupation of Chitral.

The next war services of Colonel Woodthorpe were with the Burma campaign of 1886-87, during which he accompanied a column from Assam, *viâ* Manipur, to the Chindwin river, when a large area of previously unknown country was reconnoitred.

On leaving Burma he was employed for a short time under the Foreign Department of the Indian Government, and then spent a few months in England.

For a time now—from February 1889—he was withdrawn from the Survey Department and placed under the Quartermaster-General in India, in charge of the Military Intelligence Department, a post for which his special talents and intimate acquaintance with many parts of the frontier eminently fitted him. In 1892 he again joined the Survey Department, and was placed in charge of the surveys for the Anglo-Siamese Boundary Commission. Following this, in 1894-95, another similar charge in the Mekong Commission devolved upon him. He suffered greatly in health from the exposure in the forests of the regions to which these last charges led him, and for the first time in his long service he was compelled to take rest for an extended period in England. After two years, in October 1897, he returned, though not fully restored to health, to fill the office of Deputy Surveyor-General, to which he had been appointed. The fever he had suffered from again seized him on his first tour of inspection to Burma, and he died from it soon after getting back to Calcutta. In him the Government of India has lost a talented officer of ripe and valuable experience, devoted with all his might to any work with which he might be intrusted, and his many friends have to deplore one whose geniality always made his society a delight, and whose prominent qualities were kindness of heart and great unselfishness.—J. S.

Colonel H. C. B. Tanner, whose death occurred on 16th March 1898 at Bath, where he had settled on retirement after a long and arduous career of Indian service, had taken a prominent part in many of the varied undertakings of the Survey of India. He joined the Survey Department from the Royal Horse Artillery in 1862, and was employed for several years on surveys in Sind and in the Central Provinces. There, his active habits, taste for adventure, and special talents as a draftsman marked him as well fitted for employment as survey-officer with a military expedition, and in this capacity he was selected to accompany the first advance into the Lushai country in 1871. For his services in this expedition he received the thanks of the Government of India. His success as a topographer in the Lushai country, and his further experience in delineating difficult ground in the Western Ghats of the Bombay Presidency led, on the outbreak of the war with Afghanistan in 1878, to his being attached as survey-officer to the column under Sir S. Browne, which advanced on Kabul through the Khyber Pass. His share of work in Afghanistan, where a considerable amount of surveying was done while the army remained in occupation, was in the high ranges round Jalalabad. While thus employed he conceived the daring project of penetrating, in disguise, and with the help of a chief whose acquaintance he had made, into the unknown and somewhat

mysterious country of Kafiristan. He succeeded in reaching the first Kafir village, but no farther. The hardships he had endured brought on a severe illness, and he was carried back to Jalalabad in a very helpless condition.

For his services in Afghanistan he received promotion to the rank of Lieutenant-Colonel. In 1879 he was sent to Gilgit, an outlying district of Kashmir, which for political reasons had been excluded from the survey of the rest of the State. He was engaged there for two years, and he found in the lofty mountains of the region much to tax his great powers of endurance, and to call forth physical exertions as a mountain climber such as few surveyors have been called upon to face. It may be mentioned that eight of his highest stations of observation were between 15,000 and 17,000 feet above sea-level. The region furnished much to fascinate his artistic taste in its stupendous cliffs, ice-fields, rocky gorges, and pine-clad valleys, and he was able to bring away with him a magnificent series of drawings, executed very appropriately in black and white, which, being shown at exhibitions in Calcutta and in London, have helped to make widely known the wondrous scenery of those noble mountains.

Colonel Tanner's next survey work was in Sikkim, in the Eastern Himalayas, a region of lofty ranges and deep valleys where again great physical exertion was demanded of Colonel Tanner and the surveyors who formed his party. Here he was able to view from a distance, and to sketch, the great Mount Everest, which is precluded from approach by surveyors, as it lies within the closed land of Nepal. From Sikkim Colonel Tanner and his party surveyed a large part of the boundary of Nepal westward to Kumaon, thus acquiring a knowledge of an immense extent of the outer ranges of the Himalayas.

A new sphere of survey was then allotted to him in the Himalayan territories of Kangra, Kulu, and Lahaul, and the Hill States about Simla, all dependent on the Punjab. The country was all of the same mountainous character as that in which his late surveys had been, but surveying in the Himalayas had become a delight to him, and he thought nothing of the bodily exertions it involved. He took up the work with his usual energy and laboured at it personally and in the supervision of his party for five years, until in 1890 his period of service, by the age rule, was complete, when with much regret he had to relinquish all further active employment.

Colonel Tanner had obtained an unusually extensive acquaintance with many different regions of the Himalayas, and his varied experiences in these regions formed the subject of a highly interesting lecture, illustrated with some of his own pictures, which he obligingly delivered to the Society in April 1895.—J. S.

Surgeon-Major Aitchison, C.I.E., M.D., etc.—James Edward Tierney Aitchison was born at Neemuch, in India, in 1835. He was educated at Dalkeith and Edinburgh, where he graduated, and he joined the Bengal Medical Service in 1858. He became British Commissioner at Ladak in 1872, but before this he had made his mark as a botanist

by the publication of a *Catalogue of the Plants of the Punjab and Sindh; Flora of the Thelum District;* and *Lahul: its Flora and Vegetable Products.* Wherever he went he observed with a keen eye the uses to which the natives of the district put the plants by which they were surrounded, and in this way he added much to the list of drugs which are now available for medical purposes. He served with the 29th Punjab Infantry in the Kurram Valley force, and was botanist to the force in 1879-80. To this we owe his valuable *Flora of the Kurram Valley and Afghanistan.* By this time, viz., 1883, his services as a botanist and naturalist were generally acknowledged. The University of Edinburgh made him an LL.D., the Royal Society elected him a Fellow, and the Indian Government conferred on him the decoration of C.I.E., and appointed him naturalist to the Afghan Delimitation Commission of 1884-85. To this appointment we owe *The Botany of the Afghan Delimitation Commission, The Zoology of the Afghan Delimitation Commission,* and the splendid collection of some 10,000 specimens, which are now preserved in the Herbarium at Kew. Dr. Aitchison retired from service in 1888, and his last publication was *Notes on the Products of Western Afghanistan and North-Eastern Persia.* It was characteristic of his pluck and energy, that in 1892 he essayed the hopeless task of contesting the Clackmannan and Kinross Burghs as a Liberal Unionist. He was for several years a member of this Society. He died at Kew on the 30th September last.—H. B. F.

Colonel Henry Lake Wells, R.E., C.I.E.—Through the death of Colonel Wells, the public service has lost, in the prime of his life, an able, energetic, and zealous officer, and this Society an accomplished and efficient corresponding member.

Born in 1850, he entered the army as a lieutenant in the Royal Engineers in 1871. From the first he showed a special aptitude for survey work, for which his subsequent career furnished ample scope, most of his service having been in such unsurveyed regions as the extreme north-west frontier of India, Baluchistan, Afghanistan, and Persia, in all of which he made valuable additions to the accumulated stock of geographical and topographical knowledge. During his service with the Afghan Field Force in 1878-79, he built the native cantonments at Quetta, and with Ghilzai labourers constructed the road over the Khojak Pass, now to a great extent superseded by the railway. He afterwards made a special survey with a view to the establishment of telegraphic communication between Srinagar and Gilgit. In 1880 Captain Wells was appointed Assistant Director of the Persian section of the Government Indo-European Telegraph Department, of which Colonel (now Major-General Sir Robert) Murdoch Smith was Director, whom he succeeded in the Directorship in 1885. In the summer of the past year he was transferred to the submarine section at Karachi, where on the 31st of August he fell a victim to enteric fever within a month of his arrival.

In the course of his long residence in Persia he made many official journeys in different parts of the country, and never failed to take the

opportunities they afforded for making new route surveys and correcting old ones, notably of the routes leading from the Karun river to Ispahan in one direction and Shiraz in the other. He communicated to this Society an interesting narrative of a tour in Mazanderan, which appeared in the *Magazine* for January 1898.—R. M. S.

Francisco Coello de Portugal y Quesada.—On September 30th, at Madrid, died the most noted geographer of Spain, Sr. D. Fr. Coello, at the age of seventy-five. In 1839 he entered the army, and he rendered important military services to his country. In 1865 the direction of the geographical, geodetical and geological departments of Spain were intrusted to his care. The following year he retired from active service with the rank of Colonel of Engineers, but still continued to forward the interests of science, especially geography. He was the founder, and for many years president, of the Geographical Society of Madrid, which he frequently represented at scientific congresses abroad. The work by which he is best known is his *Atlas de España y sus Possessiones de Ultramar*, in 65 sheets, on the scale of 1 : 200,000, the first complete and correct cartographical representation of his country and its colonies. His loss will be much felt in geographical circles.

Ramon Lista.—For more than twenty years Lista devoted his energies to the exploration of the remote regions of the Argentine Republic, and to the advancement of science in various directions. In 1877 he travelled in Patagonia and discovered the Rio Belgrano, which he traced up to its sources, a few miles from the Lago San Martin, and, again, in 1884 he traversed an immense zone of Northern Patagonia, making important observations on the character of the country and surveys which are still the most reliable existing. On another occasion he made a voyage to Tierra del Fuego, collecting data which were used by Sr. Popper in the construction of his map, and subsequently for the Atlas of the Republic, issued by the Instituto Geografico; and when governor of the Territory of Santa Cruz he spent his leisure in acquiring scientific information about this extensive region.

Lista was very successful in ingratiating himself with the Indians. He lived among the Tehuelches and learned their language, and was thus enabled to gain a thorough knowledge of their character and customs. This primitive people he described in a work entitled: *Una Raza que desparece: los Indios Tehuelches.* He also published *Mis Exploraciones y Descubrimientos de la Patagonia*, 1877-1880, besides contributions to the *Boletin del Instituto Geografico Argentino* and other periodicals.

In the autumn of 1897 he set out on an expedition to explore the upper waters of the Pilcomayo, in connection with the frequently agitated question of water communication with Bolivia, and while making a preliminary excursion in Miraflores, north of the Rio Bermejo, was murdered and robbed by his companion, probably on November 20th. The news of his sad fate was received with great sorrow and no little consternation by his fellow-countrymen, and especially by the members of the Instituto Geografico, who had equipped the expedition. A party was at once despatched to bring his body to Buenos Ayres for interment.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Meeting of Council.

At a meeting held on December 15th, the following ladies and gentlemen were elected Members of the Society :—

Boswall, Miss Beatrice M. R.
Cowan, Mrs. A. O.
Kerr, Miss.
Kirkpatrick, Miss M.
Melville, Miss A. M.
Milne, Mrs. Leslie.
Vertue, Mrs. Clara.
Watt, Mrs. Anderson.
Bishop, James.
Brown, Chas., J.P.
Cowan, Alex.
Gemmell, Matthew.
Gilroy, Prof. Jas.
Goold, Geo. S.
Greenhill, Wm.
Hammond, J. Hays, Ph.B., M.A.
Hart, Geo. B.
Hunter, John L.
MacKechnie, R. M.
Maclay, Wm.
Rattray, Geo., M.A.
Scott, Dr. Robert.
Smith, W. Muir.
Smith, J. Shanklie.
Thomson, J. Graham.
Urquhart, Jas.
—In all twenty-six.

The names of eight members, whose subscriptions are in arrear, were struck off the list.

Major-General P. C. Dalmahoy, Mr. J. R. Reid, C.I.E., and Mr. G. W. Baxter (Dundee) were elected temporary members of Council to fill up vacancies.

Ordinary Diplomas of Fellowship were conferred on Mr. George Bickerton and the Rev. Dr. A. J. Milne.

Mr. J. B. Tyrrell (Canada) was elected a Corresponding Member ; and Sir John Murray, K.C.B., was appointed the Delegate of the Society to the International Geographical Congress, which will be held this year in Berlin.

Meetings held in December.

Lieut. Meiklejohn, of the Gordon Highlanders, lectured on Dec. 14th in Edinburgh, the title of his address being "Notes on Tirah." Colonel Cadell, V.C., presided, and General Chapman moved a vote of thanks to Lieut. Meiklejohn.

Lieut. Meiklejohn delivered his lecture to the Glasgow Branch on Dec. 13th. Sir John N. Cuthbertson took the Chair.

On Dec. 15th Lieut. Meiklejohn addressed the Dundee Branch, when Mr. I. J. Weinberg presided.

The following evening he appeared before the Aberdeen Branch. Dr. Wm. Ferguson of Kinmundy presided, and Prof. Pirie proposed the vote of thanks.

Lectures in January.

On Jan. 19th Mr. W. S. Bruce will lecture in Edinburgh on his recent voyage to the Arctic seas.

Mr. Savage Landor has consented to lecture at Glasgow and Dundee some time in January.

GEOGRAPHICAL NOTES.

By The Acting Editor.

EUROPE.

Regulation of Lake Trasimene.—We are indebted to Professor Paul Chaix of Geneva for the following account of the engineering operations lately executed:—

"Lake Trasimene, of imperishable fame in history, is a sheet of water about 50 square miles in extent. Its length is 9·3 miles and its breadth 6·3, and the irregular line of its periphery measures 32 miles. Surrounded by picturesque and sunny hills, studded with old castles and splendid olive groves, its shores will be salubrious enough now that its surplus waters have free means of escape. The lake has no natural emissary, and hitherto the only outlet has been a small, tortuous, half-choked-up ditch, the construction of which is ascribed by some to the Romans and by others to the famous Braccio de Montone, Lord of Perugia, a rival of Attendolo (Francesco Sforza).

"Such a ditch is totally incapable of affording a free outlet to the volume of water collected from a basin 93 square miles in area, and consequently the waters of the lake sometimes rose as much as 9 feet above their mean level, flooding a belt of well-tilled lands into pestilential swamps. The fever-stricken and helpless inhabitants bore this scourge for centuries, receiving no assistance from the Pontifical Government, which exercised its administrative powers in this district only in making absurd regulations relating to navigation and fishing. The Italian Government, in 1864, granted a concession for entirely draining this beautiful lake to certain speculators, who, happily, could not raise the necessary funds.

"In the year 1875 a flood of unusual height and duration brought the patience of the surrounding population to an end; and a general meeting, convened on September 24, 1877, by Cavaliero Guido Pompili, decided on the formation of an association for the purpose of constructing a proper drainage channel. Cavaliero Guido Pompili, notwithstanding his youth, was appointed president, an office he still retains. The next two years were spent in the necessary soundings of the lake and measurements of the variations in the volume of water, and in surveying the country intervening between the lake and the Tiber. The bill had then to run the gauntlet of corporate bodies of all kinds, provincial, sanitary, parochial, agrarian, amid endless discussion and stupid and often culpable opposition. In 1891 the project was submitted to three well-known engineers, MM. Brioschi, Cadolini, and Coletti, who in their report handed in in March 1891, submitted a plan involving an outlay of £68,120, to be borne entirely by the association. It was not, however, until July 14, 1895, that a royal decree was issued, authorising the execution of the work under a commission, whose chairman was the sanguine and talented Cav. Guido Pompili, and which consisted of several engineers, the Marquis Ruggiero Sorbello, Count Francesco Conestabile, and others.

"The new canal starts from the south-eastern corner of the lake at an altitude of 848 feet above sea-level, and by a channel 3 mètres broad (nearly 10 feet) enters a trapezoidal basin 46 feet long. Thence the water is carried by an elliptical tunnel, 10 feet 6 inches broad and 1078 yards long, under the hill and village of San Savino del Lago. On emerging it enters a walled channel 284 yards long, and then, by a trench 3 miles in length, reaches the Caina, a small tributary of the Tiber. The work was carried on briskly, and was concluded by the opening of the upper extremity of the canal, a somewhat difficult undertaking owing to the high level of the water in the lake. The maximum discharge of the new emissary is 12 cubic

mètres per second, and it has been calculated that twenty-four months will be required to drain off the 205 million cubic mètres (about 7240 million cubic feet) lying above the newly adopted level. Thus 2500 acres of land will be obtained for agricultural purposes, and 2500 more will be reclaimed from the swampy condition which has for centuries given a bad name to the lake.

"The works were two years under construction, and were completed on March 15, 1898, at a cost of only £25,900, instead of £68,120 as estimated. The result shows that poor Italy may yet attain prosperity, if it can get rid of the blood-sucking bureaucracy that feeds on its splendid territory. The canal, after an examination by engineering experts, was formally opened on February 27th amid great rejoicing."

The Mälar Lake.—The basin of the Mälar embraces the greater part of the Stockholm, Upsala, Vestmanland and Örebro provinces, as well as smaller portions of Södermanland, Kopparberg, and Warnborg (?). Its area amounts to 8791 square miles, of which 1224 are occupied by lakes, among them the Mälar, the third among the lakes of Sweden, with a surface of 449 square miles, and Hjelmar, 185 square miles in extent. The length of the Mälar lake is 73 miles, while its breadth varies from 2½ furlongs to over 30 miles. Numerous islands lie in the open lake as well as in the numerous fiords and channels, having an aggregate area of 189 square miles, or greater than that of the Hjelmar lake.

Stockholm stands where the water from the Mälar lake pours into the Baltic, with the lake on the west and a branch of the Saltsjö on the east. Originally the lake had only one outlet, the Norrström; the second, the Söderström, came into existence above nine hundred years ago. The drainage is very defective, and the level of the water in the lake is consequently subject to great variations, causing occasionally, as in 1550, 1780, and 1850, disastrous floods. To obviate these the channels have repeatedly been cleared out, but with so little judgment that the only result has been the lowering of the low-water level to the great inconvenience of shipping. The great hindrance to the regulation of the outflow has been the Helgeandsholm, a small island opposite Stockholm, which takes up a third of the bed of the Norrström. But since the shores of the island have been given another direction through the construction of new works, the difficulty has been removed.

According to Rosen's observations the mean level of the water in the Saltsjö stands has for the years 1871 to 1895 been about 12 feet 10 inches above the bottom of the sluice at Riddarholm, and the mean level of the Baltic at Grönskär is nearly 2 feet lower than at Stockholm. The mean level of the Mälar lake is about 13 feet 10 inches above the sluice bed. Naturally the Mälar with its great length, receiving considerable tributaries in its western part, does not present a uniformly level surface. During the years 1887 to 1895 the average difference between Gallen and Stockholm was only 1·2 inches, though at times the difference rises to 1 foot 10 inches.—*Globus*, Bd. lxxiv. No. 12.

ASIA.

The Peoples of the Philippines.—Professor D. G. Brinton, of the University of Pennsylvania, has contributed an article with the above title to the *American Anthropologist*. The estimates of the population of the archipelago vary from five to ten millions; perhaps six and a half millions are not above the mark. Of these about one-half live on Luzon and the adjacent isles, five hundred thousand on Mindanao, one hundred thousand in the Sulu islands, and the remainder in the central group known collectively as the Bisayas. Of the total only nine thousand are pure whites, not including those connected with the civil and military departments

of the Government, and about twelve thousand are half-breeds; the Chinese and Japanese number nearly fifty thousand; and the remainder consist of small black Negritos, now reduced to some ten thousand, and the brown Malayan tribes, who form the large majority.

It has been very generally accepted that the Negritos are of the same race as the Papuans of New Guinea, and that they were the first inhabitants of all the large islands in this part of the ocean, occupying them undisturbed till two thousand five hundred to three thousand years ago, when Malayans landed and drove them into the mountains and jungles of the interior. Some authorities, however, assert that they are of Malayan race. The presence of the Malays is due to several migrations. The earliest immigrants were savages allied to the Dyaks of Borneo, and are represented by the Apoyas, Zambales, Irayes, and Catalangans of Luzon. The people of the second immigration were more cultured and were acquainted with an alphabet; their main body arrived between 100 and 500 A.D., and their descendants are the Tagalas, Bicols, Bisayas, and Ilocanes. Lastly, the Islamitic propaganda introduced in the fourteenth and fifteenth centuries Malays with a large admixture of Arab blood, the Moros, into the Sulu islands and the eastern coast of Mindanao. Some anthropologists have supposed that the first immigrants were a white race, to whom they have given the name Indonesian, who left India about 500 B.C., but their arguments, based solely on anatomical grounds, do not seem conclusive.

The Negritos, known also as Aetas and by various local names in different parts of the archipelago, are the most interesting. The men are about four feet eleven inches high, and the women about an inch shorter. They become old at forty to forty-five years of age, and rarely pass fifty. The skull has a capacity in fair proportion to the stature, eleven hundred to twelve hundred cubic centimètres. It is decidedly round, the cephalic index running up to eighty-five on an average and occasionally up to ninety. In this the Negritos are in marked contrast to the Mincopies of the Andamans, who are dolichocephalic. The legs of the Negritos are extremely thin, almost destitute of calves, and their tibiæ are flattened. Their hair is woolly, their colour black, and their faces prognathous. The beard is usually scanty. In culture they are very primitive; they have no fixed dwellings, they make no pottery and do not till the soil, and their clothing is merely a girdle. They occasionally use the blow-pipe, but their chief weapon is the bow. As a rule they are inoffensive and shy. The scanty vocabularies that have been compiled of their language show that, while a large number of words have been borrowed from Malayan, there is an independent tongue.

Fully eleven-twelfths of the inhabitants of the Philippines are of more or less pure Malayan descent. They are popularly termed Filipinos. They vary greatly in appearance, culture, and language. The Spanish Government recognised officially thirty-five different languages in the archipelago, and Professor Blumentritt has divided the Malayan population into fifty-one linguistic groups. It would be impossible in a short paper to treat of so many subdivisions, and therefore Professor Brinton takes the following groups:—(1) The mixed tribes of northern Luzon; (2) the Tagalas and Bicols of central and southern Luzon; (3) the Bisayas of the central archipelago; and (4) the Moros of eastern Mindanao and the southern islands. The tribes of northern Luzon represent crossings of the Malayan with Chinese and Negrito blood. Many of them have never been converted to Christianity, and preserve their ancient customs of tattooing, filing the teeth, and occasionally head-hunting. They often dwell in buildings raised above the ground, grouped together. Their system of government is patriarchal, and those who have not been converted are polygamous.

The Tagalas are of comparatively pure Malayan race, and exhibit the facial characteristics of that people. Formerly they lived in patriarchal fashion, each village having its *dato* or headman. Their religion was a nature-worship, which they readily exchanged for Christianity when the Spanish missionaries came among them. Competent agriculturists, industrious, lovers of gain, and with pronounced commercial instincts, they extended their trade into far distant seas long before the Europeans arrived. They are passionately fond of cock-fighting, chew betel-nut, and smoke immoderately. Their staple food is rice, cooked preferably with fish. Of their moral character no good report has been given by those who have come into contact with them. The language of the Tagalas, called the Tagalog, is one of the most highly developed Malayan dialects. It has been from the earliest known times a written language, and was originally written downwards on canes, but the missionaries introduced the writing from left to right. The alphabet can be traced back to a script found on very early Buddhist monuments in India, erected about 500 B.C.

The Bicols are the southern branch of the Tagalas, speaking a distinct dialect. They inhabit the peninsula of the Camarines and the northern portion of the adjacent island Masbate.

In physical appearance the Bisayas resemble the Tagalas. At the time of the discovery of the islands they were as highly cultured, but their homes being more exposed to attack they have made no progress: many tribes, indeed, have relapsed into a savage state. Whether the Bagobos and other wild tribes of the interior of Mindanao should be classed with the Bisayas is uncertain. Schadenberg collected a vocabulary, which is evidently Malayan; he speaks of them as unspoiled by civilisation and uncommonly honourable.

The people called Moros by the Spaniards are a mixed Malayan and Semitic people, who came across from Borneo through the Sulu archipelago to Mindanao, bringing with them the Koran and establishing important sultanates. They were inveterate pirates and daring sea-rovers. One of their open boats will, at the present day, make the voyage to Singapore, twelve hundred miles, without a compass.

AFRICA.

Dr. Hans Meyer in East Africa.—A letter from Dr. Meyer, dated Moshi, September 16th, is published in *Globus* for October 29th. The plan he formed previous to his departure from Europe was to ascend Mawenzi from the east and north-east in order to examine the old crater and the immense fissures that traverse the mountain in a north-westerly direction; secondly, to ascend Kilimanjaro from the Masai plain on the north, climb once more the Kibo crater, and investigate the present state and structure of the ice; thirdly, to march round the mountain on the north and west above the forest and examine the ice on those sides; fourthly, to examine the great western fissure of Kibo, and the Shira ridge running out westwards, in connection with the structure of the whole elevation; fifthly, to climb the west side of Kibo as far as the ice and make observations of the former extension of the ice on this, the most extensively glaciated, flank of the mountain; and sixthly, to make a cartographical survey of the region traversed, take photographs and make geological, botanical, and ethnographical collections.

This programme has been carried out in all points. On August 9th Dr. Meyer left Moshi and ascended through Marangu above the forest to the east side of Mawenzi, reaching a height of 12,800 feet, and then descended to Useri. By this excursion he gained an exact idea of the formation of the great fissure. It is not a gully excavated by erosion, but a violent dislocation accompanied by subsidence

of considerable masses on the east side. A zone of eruption with several small hills continues the direction of the fissure across the plain and up to the Ongolea, which is also entirely volcanic.

On another occasion Dr. Meyer ascended with Herr Platz through the pathless northern forest to a height of 12,500 feet on the *Ericinella* region far above the tree limit. Climbing still higher, he pitched his camp at the rocky north-eastern foot of the glacial detritus which forms the steep summit of Kibo. After a night in which the thermometer sank to 18° F., the explorers struggled up into the crater through the Hans Meyer cleft. The eruption cone was found to be much freer from ice than in 1889; the ice masses stretching on the south side of the crater bottom to the western fissure were of smaller dimensions, while the melting of the walls of ice descending into the crater from its northern edge was more considerable than nine years ago. Outside the crater the Ratzel glacier on the east has moved forward and is now full of crevasses, while on the north-east a new tongue of ice protrudes from the upper crown of ice down to about 18,000 feet above sea-level. Dr. Meyer and his companion marched round the north and north-west sides of the mountain between the heights of 7200 and 12,500 feet. On the north-west a hilly eruption zone radiates out from Kibo down to the plain, and one still more extensive lies on the west-north-west and west of this crater, where later outbreaks at about 13,500 feet have built up a group of rugged cones and flooded the western flank of the mountain with colossal lava streams, forming a plateau. This Dr. Meyer named the Galuma plateau after a larger cave at a height of 11,800 feet, where he pitched his tents. Climbing up to the western Kibo cone, he discovered three large independent glaciers descending to a height of 16,000 feet, with several morainic belts of late formation in front of them, and, below these, broad troughs, 2½ to 3 miles long, and accompanied by high lateral moraines which exhibited marked signs of their glacial origin down to 12,500 feet. The middle glacier Dr. Meyer named after Dr. Erich von Drygalski.

Passing over the Shira ridge from the Galuma plateau to Kibonoto-Maëmbe, Dr. Meyer perceived that this is not fractured off from the plateau but is an independent ridge with layers of lava sloping steeply south-west and south and but little disturbed. On the north and east sides it is covered by the later streams from the western foot of Kibo, and much eroded on the south and south-west by rain and water from glaciers. The great western fissure of Kibo, probably formed originally by dislocation, turns in its lower part to the south at right angles and bears on its northern and eastern inner walls two steep glaciers which are drained into the Weruweru river. The one to the east reaches lower down than any other glacier in Kilimanjaro (about 13,800 feet).

Another ascent was made with Father Rohmer from Kibosho. From the Mbassa cave (10,000 feet) they ascended to the south-east foot of Kibo, leaving the Ratzel glacier on the north and traversing deep gorges and valleys. The whole route lay across glaciated ground, the lowest moraines and striated rocks lying at a height of 12,000 feet, or at about the same level as on the western side. At 15,900 feet they came to a glacier from which, to their astonishment, they descried six glaciers, the most imposing glacier zone on the mountain. The forms of the ice surface differ essentially from those on the east and west side.

ARCTIC AND GENERAL.

Spitzbergen.—In the *Verh. der Gesell. für Erdkunde zu Berlin*, Nos. 8 and 9, 1898, Captain Rüdiger gives an account of the voyage of the *Helgoland* to the northern seas during the past summer. Drs. Schaudinn, Römer, and Brühl were

the scientific members of the expedition. The ice conditions last year were extremely favourable, open sea extending at the end of July and throughout August almost all round Spitzbergen and far to the east and north-east of Kong Karl's Land. This was due to the warm Gulf Stream, which penetrated far to the east, driving back the cold Polar current, producing, however, much fog, which was a great hindrance to geographical observation. The *Helgoland* steered first for the Storfiord, where the tidal currents in the Thymen strait were observed. The northern part of the fiord was found to be inaccurately represented on maps. A current runs from the Olga sound round Cape Negro into the Storfiord, and flowing a little beyond the Thymen strait crosses over to West Spitzbergen, and passes round South cape into the open sea. From Storfiord the vessel passed round the west coast of Spitzbergen, which is much frequented in summer by tourist vessels, and sailed northwards as far as Ross island, where, at lat. 80° 48′, the thermometer stood in July at 46·7° F. Farther south, in Riips bay, the sun shining brightly, the shade temperature was as high as 52·7°. On the return southwards the *Helgoland* steamed down Hinlopen strait as far as Cape Torell, where continuous ice prevented further progress. Hinlopen strait is a deep depression, soundings of 235 and 246 fathoms having been taken.

Perhaps the most interesting part of Captain Rüdiger's narrative is that relating to Kong Karl's Land. Having passed Cape Negro he set his course for Cape Hammerfest, the southern extremity of the Swedish Vorland, and the next day, July 23rd, found himself at Jena island, having passed the Swedish Vorland in the fog. It turned out that this island is given twice its actual length on maps, and that while the northern extremity is properly placed, Cape Hammerfest is placed much too far south. The island is mountainous, and extends little more than ten nautical miles from north-north-west to south-south-east. Its highest elevation, the mountain Haarfagrhaugen in the northern part, is a regular, truncated pyramid rising to a height of 1700 to 2000 feet. Jena island lies east and west with a length of about twenty, and an average breadth of two to three, nautical miles. It consists of two elevated parts on the west and east, separated by low alluvial land, which, covered with ice, may be mistaken for a sound. The western part rises to a height of 1300 to 1600 feet, and contains a mountain very similar to Haarfagrhaugen, called the Emmy mountain by the expedition. The eastern part is lower, its highest elevation, Mount Martha, being only 330 feet or thereabouts. Seven and a half sea miles from the east cape of Jena island lies a third, possibly Pike's Abel island, which is much smaller, being about five miles by four. It is low and is built up of débris, the highest point rising only some fifty feet above the sea. It is a breeding-place of the ivory gull. (Mr. W. S. Bruce saw distinctly four islands from the *Princess Alice*, the little Abel island lying between Jena and Captain Rüdiger's third island.) The large islands reported by the whalers *Andreassen* and *Johannessen* to the north-east of Kong Karl's Land could not be found, though the *Helgoland* steamed nearly forty miles in that direction.

On August 5th the vessel left Kong Karl's Land and passed round the eastern side of North-East Land, the first time the feat had been accomplished. To pass from north to south is an easy matter, but in the other direction the voyage is difficult and often dangerous, owing to the currents and prevailing west and north-west winds. From the Seven islands the expedition sailed northwards. At 81° 13′ N. lat. the first drift-ice was seen. The depths here were from 89 to 97 fathoms, but they rapidly increased northwards to 279 at lat. 81° 20′ and 629 at 81° 30′. No doubt the depth continued to increase, but the sounding-line was too short to measure it. At lat. 81° 32′ and 20° 52′ E. long. the vessel encountered compact

ice, and turning back sailed through Hinlopen strait and Bismarck strait, between Wilhelm's island and West Spitzbergen, and made its way home past Hope island.

A New Mountain Aneroid.—In reviewing Mr. Whymper's books, particularly *How to use the Aneroid Barometer* vol. ix. p. 333), we have noticed his comparative observations of aneroid and mercurial barometers under very low pressure. Between 1879 and 1890 he made observations out of doors up to heights of above 20,000 feet, and in the laboratory down to a pressure of 14 inches, corresponding roughly to an elevation of 20,770 feet. The facts brought out by these experiments were that the aneroid, though it might for a moment read correctly when the pressure was reduced to, say, 20 inches, soon fell below the mercurial barometer, and that this loss continued to increase during several weeks, sometimes reaching half an inch or more. Again, when the pressure was restored, either suddenly or gradually, as when a traveller descends from a mountain, the aneroids began at once to recover the loss. Consequently travellers may frequently record heights much in excess of the actual, and, owing to the recovery of their instruments on a return to low elevations, be unable to detect the error. Mr. E. A. FitzGerald found that at 19,000 feet his aneroids registered 12 inches of pressure, corresponding to a height of 25,000 feet.

The publication of Mr. Whymper's results led to improvements in the manufacture of aneroids, and some instruments of the best class show a distinct advance towards accuracy. Inventors have endeavoured to obviate the difficulty by shortening the time during which the aneroid must be exposed to low pressure. The most recent instrument on this principle has been constructed by Col. H. Watkin, C.B., Chief Inspector of Position-Finding in the War Department. To relieve the strain on the mechanism and allow it to be put into action only when an observation is to be taken, the lower portion of the vacuum box is not a fixture, as in ordinary aneroids, but is allowed to rise. When a reading is required it is brought down to its normal position by means of a screw.

Mr. Whymper was not very sanguine as to the efficiency of the new invention, but consented to give it a fair trial in the field. After satisfying himself that it was not affected by variations of atmospheric pressure when thrown out of action, among other ways by keeping it for six weeks under a receiver at a constant pressure of 17 inches, he took it to Switzerland in September last. At Zermatt, 5315 feet above sea-level, twenty-one readings were taken between the 3rd and 8th of the month, the aneroid being thrown out of action immediately after each observation, and it was found that while there was an accumulation of loss, the amount was small. The aneroid showed a plus error of 0·122 in. at the first reading, which was reduced to 0·69 at the last, so that the average loss at each reading was 0·00252 of an inch. On Sept. 9th Mr. Whymper took the instrument to the top of the Gornergrat, making observations on the way and on the Gugel, with the result that the apparent error on the Gornergrat was – 0·052. The mean error of eight readings taken at Zermatt on four following days was + 0·068 in. On Sept. 13th the aneroid was again read on the Gornergrat, when the error was only – 0·012 in.; and this confirmed Mr. Whymper's suspicion that on the previous occasion the mercurial barometer was read before it had sunk to the temperature of the air. After this second visit to the Gornergrat two readings of the aneroid at Zermatt gave a mean error of + 0·030 in. Mr. Whymper subjected the instruments to further trials in the Zermatt and Rhone valleys, of which he gave details in the *Times* of Dec. 17th. In all these observations the mean error in no case rose to a tenth of an inch, and better results, he believes, would have been obtained if the

readings had been taken more quickly. If the instrument be thrown out of action immediately after a reading is taken and the readings are taken as quickly as possible, extraordinary results may be obtained with Watkin's Mountain Aneroid. The instrument used was 4½ inches in diameter and was divided to 0·05 in. Its scale ranged from 31 to 17 inches, and it weighed in its leather sling case 2½ lbs. The maker is Mr. J. J. Hicks of Hatton Garden.

MISCELLANEOUS.

The **beaver** is being rapidly exterminated in the Rhone valley. M. Mingaud has drawn public attention to this regrettable fact, and suggests that a colony of beavers should be formed and protected as in the National Park at Washington.

The Twelfth **International Congress of Orientalists** will meet at Rome on October 2nd. Members who desire to avail themselves of the reduced fares on the Italian railways, to join the excursions, etc., are invited to apply to the Secretary of the R.S.G.S.

A **meteorological observatory** is to be erected on the Zugspitze, the expenses of which will be borne by the Bavarian Government and the German and Austrian Alpine Club. The Zugspitze, lying south-west of Garmisch on the frontier of the Tyrol, is 9700 feet high, and is the most elevated peak of the Bavarian Alps, and, indeed, in the German empire.

The third report of the International Commission on **Glaciers**, edited by Professor E. Richter, contains details of observations in the Alps, Spitzbergen and Franz Josef Land, Greenland, America, the Caucasus, etc. In some cases the period of advance has been determined, and in many cases interesting irregularities have been observed in the rate of progression.

In March 1898 Dr. Preuss ascended the **Cameroons Peak** and made several observations with a boiling-point thermometer. Hence he calculated that the Fako summit, probably the Albert Peak of Burton, is 13,370 feet above sea-level. Former measurements differ considerably, partly because they were not all taken on the same summit.—*Mitth. aus den Deutschen Schutzgebieten*, Bd. xi. Heft 3.

In the September number of the *Boll. della Soc. Geogr. Italiana*, the following areas of the **British Possessions** on the west coast of Africa, as limited by the recent Anglo-French convention, are given from planimetric calculation by Dr. H. Haack:—Gold Coast, 65,200 square miles; Lagos, Niger Coast Protectorate and the territory of the Niger Company, 367,000 square miles; neutral zone (between Ashanti and Togoland), 15,780 square miles.

The area of **Japan** is 147,613 square miles. The population is rapidly increasing: whereas in 1885 the number was 38 millions, in 1895 it had risen to 42,270,620, or more than 286 to the square mile. The increase is due to excess of births over deaths. The death-rate amounts to about 20 per 1000. The number of marriages is large: in 1895 they numbered 365,633, while the divorces were 110,838.—*Verhandl. der Gesell. für Erdkunde zu Berlin*, No. 7, 1898.

The railway from **Sfax to Gafsa**, 128 miles long, was completed in September last, having been about twelve months under construction. Besides the phosphates, of which the chief deposits are at Metlaoui, thirty miles from Gafsa, numerous minerals, zinc, mercury, etc., will probably be transported by this line, which will be prolonged to Tozeur, fifty-two miles from Gafsa, and to Nefta, drawing to the port of Sfax the excellent dates of Tozeur and the textiles of the Djerid.—*Annales de Géographie*, November 15th, 1898.

The **German Deep-Sea Expedition** on the *Valdivia* arrived at Table Bay at the end of October. Professor Chun and his colleagues were entertained at a banquet by the Council of the South African Philosophical Society and the Mayor of Cape Town. The *Valdivia* results prove the existence of Bacteria at depths of 3200 fathoms, while fish that were regarded as peculiar to great depths have been caught in depths of 500 fathoms or less. The *Valdivia* left Cape Town on November 13th.—Communicated by Prof. Corstorphine.

The Seventh International **Geographical Congress** will be held at Berlin from September 28th to October 4th, under the management of the Gesellschaft für Erdkunde. The subjects of discussion will be much the same as at former meetings. Notice should be given before April 1st at the office of the Congress, 90 Zimmerstrasse, Berlin, S.W., of papers which authors propose to read, and the manuscript should be sent in before June 1st. Fuller information will be found in the circulars sent out with this number of the *Magazine*.

In the *Quarterly Journal* of the Royal Meteorological Society, October 1898, Mr. R. C. Mossman gives an account of non-instrumental **Meteorological phenomena in London** during the years 1763-1897, in connection with the direction of the winds. Figures interspersed among the type, consisting of wind roses on which the frequency of the various phenomena is marked, enable the general results to be perceived at a glance. Thus hail is most common with west winds, and is also not infrequent with north and north-west winds. Summer thunderstorms are most frequent with west winds, while the occurrences of lightning without thunder reach a maximum with east winds, and are also common with south winds. The wind most favourable for fogs is the east, and auroras occur most frequently with west and south winds.

In vol. xi. p. 304 was published a brief description of the **Camargue**, or delta of the Rhone, from a paper by Mr. Eagle Clarke in the *Ibis*. Last October the author contributed a second paper to the same periodical continuing his observations on the ornithology of the district. He much deplores, as an ornithologist, the extension of drainage and cultivation which is fast sweeping away the pools and reedy marshes which once harboured the Sea-Eagle and the beautiful Poule sultane (*Porphyrio caruleus*). The southern region is so highly impregnated with salt that it has baffled the efforts of the agriculturist, but the salt industry and works erected for the extraction of the valuable iodides and bromides contained in the raw salt will probably soon drive away the flamingoes which haunt this corner of the delta. The greater part of the paper consists of notes on the various birds noticed in the delta.

The Twelfth **International Geodetic Conference** was held at Stuttgart from October 3rd to the 12th. It was decided to continue for five years observations of the altitude of the Pole at four stations lying nearly on the same parallel, in order to determine more exactly the movements of the Earth's axis of rotation. The amplitude of its movement according to measurements already made amounts to about three seconds of arc, corresponding to a linear displacement of 33 feet. The stations chosen, all near to the parallel of 39° 8′ N. lat., are :—San Pietro, west of Sardinia (8° E. long.) ; Midsusawa, Japan (141° E. long.) ; Ukiah, California (123° W.) ; and Gaithersburg, Maryland (77° W.). To these were added, at Professor Albrecht's suggestion, Cincinnati (84° W.) and Charjui, on the Arundaria (64° E.). As, moreover, Chandler has shown that the movement of the Pole is composed of two, a circular one with a period of fourteen months, and an elliptical one with a period of twelve months, so that a complete cycle is accom-

plished in seven years, it is to be hoped that the observations will be continued for this length of time.

The Conference voted £800 for the preparations necessary for repeating the measurement of the arc in Peru made by Bouger and Condamine a hundred and fifty years ago. Whether it should be executed by American, French, or Spanish geodetists is left to diplomatic negotiations.

Professor Helmert of Potsdam reported that about 1400 pendulum stations in almost all the countries of the world were in activity. A change in the formula deduced empirically by the speaker in 1884 might be found necessary when the observations made in America were compared with the European, and when the results of the measurements of gravity made in recent years in Greenland and Siberia were reduced.—*Geogr. Zeitschrift*, Heft 12, 1898.

NEW BOOKS.

Sur le Niger et au Pays des Touaregs. La Mission Hourst. Par le Lieutenant de vaisseau HOURST. Illustré de 190 Gravures et accompagné d'une Carte. Paris: Librairie Plon, 1898. Pp. 479. *Price* 10 *fr.*

Commandant Hourst's book on the Niger will be a fitting pendant to Major Marchand's account of his journey to Fashoda, and between the two travellers we find many points of resemblance. Endowed with indomitable perseverance, they fought their way unaided to their respective destinations of Broussa on the Niger and Fashoda on the Nile, and at each of these places they shared their last bottle of champagne with the representatives of Perfide Albion. M. Hourst, indeed, dreaded—if we may use the term with so brave a man—this meeting more than all the dangers of the road, and a thrilling account of his feelings will be found when, with an "esprit calme," rendered so by the providential fact that 30,000 cartridges still remained in the magazine, he received on board his boat an unsuspecting "executive" officer of the Royal Niger Company.

But the Mission Hourst was a peaceful one. A party of only five, with twenty-eight natives—one of those "small troops, so diminutive that the echoes of their firing could easily be lost amid the great tracts of Africa"—they set out just 100 years after a similar attempt made from New Guinea by Mungo Park, who died, it seems, at Gilaoua, and not at Broussa, and who "est demeuré immortel rien que pour avoir tenté" what M. Hourst accomplished! After many disappointments and delays this Mission arrived, 11th January 1896, at Timbuctu, which is aptly described as the "point de rencontre du chameau et de la pirogue," and not a "port du Niger sur le Sahara," but a "port du Sahara près du Niger." There our author was lucky enough to enlist le Père Hacquart, "ancien commandant des frères armés," an admirable interpreter and a man of culture and resource. Leaving in their three boats on 22nd, the Mission began its actual work, and after two days' vainly essaying a movable triangulation of the river, with one boat sounding the channel, and the other two following the banks, they gave up this scientific but too slow "travail hydrographique," and by adopting the usual method of charting the stream, have added considerably to our geographical knowledge. To ethnologists, too, the lengthy descriptions of the veiled but manly Tuareg tribe will be interesting, and the too large space they occupy in the volume is explained by the vastness of the tract, from Timbuctu to Say, over which they roam. Described by Herodotus, and of very ancient lineage, with "tifinars" or writings of the Carthaginian period, they rendered good service to Barth and the young Duveyrier, the short

story of whose life is pathetically told; whereas the "English would have made him a peer of the realm," the non-recognition of his services drove him to suicide at the age of twenty-three. To his eulogistic opinion of the Tuaregs, Col. Flatters, the explorer, is said to have owed his death some twenty years ago; *à propos* of which a rumour is published this month of his being found in captivity on the confines of Algeria—a good excuse for further rectification of that frontier. Whether the proper derivation of "Tuareg" signifies "nomad" or "God-forsaken" is not clear, but they seem to be connected with Tarik, the conqueror of Spain, and the pretty legends of their origin from genii, of the reason of their men wearing veils, and why nephews succeed instead of sons, are well worth reading. The "petites histoires modernes" with which the book abounds will be found interesting or not according to the taste of the reader, but certainly one-third of the volume will bear very superficial perusal—and in this fraction we must include the tedious description of the passage of the cataracts from Ansongo downwards, the methods of surmounting one being, as on the Nile, the counterpart of another, and we turn in relief from the vivid but thoroughly French description of days, "fertiles en émotions," spent on the banks of an apparently "infranchissable tourbillon," to the moment when comes a pious abandonment, "au courant et à la volonté de Dieu."

The personnel of the party is well described, and their individuality is always before the reader, though our author's is obscured by his adopting the name of Abd el Kader, and, for the sake of ingratiating himself with the tribes, posing as the nephew of Henry Barth, who, fifty years before, had made himself famous in those regions. Nor does his sense of gratitude to his adopted uncle save the latter from being made the hero of an amusing love-story.

The *rôle* of "funny man" is perhaps too persistently kept up, and only lapses on the various occasions, at Gao and elsewhere, when this heroic little band, beset by thousands [*sic*] of hostile natives, held their own without firing a shot; or, again, when the under current of anglophobia, excited by the view of such an eminence as Mont Wellington, necessitates the writing of many pages which one can hardly understand being perpetuated beyond the proof sheets. Still, if it is really the case that "en pleine tribune anglaise Lord Salisbury a jeté moqueusement qu'on n'avait laissé au coq gallois que du sable à gratter," at all events that plucky bird was the first to roost in Timbuctu, and its rivals will readily acknowledge the bravery and endurance of Frenchmen such as Davoust, Marchand, and Lieutenant de vaisseau Hourst; nor will they detract from the credit of the last two in concluding commercial treaties with the natives, even if these were rendered easier of ratification by the fact of their being wholly incomprehensible to one, at least, of the high contracting parties.

It is a pity a book so full of interest should be encased in such a flimsy binding, as both the volume and the interesting chart with its accompanying astronomical positions as determined by the Mission are well worth better treatment.

Supplemented by a good index, as we trust will be the case in later editions, and enriched by the same excellent engravings which adorn the work before us, Mons. Hourst's volume will prove a most valuable guide for any future expeditions up the Niger.

Summer Sailings by an Old Yachtsman. By Archibald Young, Advocate. Edinburgh: David Douglas, 1898. Pp. 225. *Price* 10*s.* 6*d.*

The author of this very attractive book describes in it the cruises he made in a cutter-yacht of thirty-five tons, in which he sailed more than 7000 miles, going

twice round Great Britain, visiting the Orkney and Shetland Islands, the Inner and Outer Hebrides, and also parts of Ireland, France, and Norway. It is illustrated with numerous hand-coloured sketches, after water-colour drawings by the author. The result of colouring the illustrations by hand, now so rare, is very effective, the lights and shadows being delightfully brought out, and the scenery represented in all the vivid tints of Nature. Altogether, the book is one highly creditable to the Edinburgh press.

With regard to the varied contents of the book, the author writes with care and knowledge. Having been formerly H.M. Inspector of Salmon Fisheries for Scotland, his remarks on piscatorial subjects will be studied with interest. He strongly recommends "the restoration of the oyster-beds in the Orkney Islands, which formerly yielded a regular supply of excellent oysters." He reminds us that the oyster industry of Scotland "may be said to be almost extinct, the total value of Scottish oysters in 1885 being only £809 against £2174 in 1884. In 1885 the once famous and productive oyster-beds of the Firth of Forth yielded only £273, and in 1884 £500. In 1885 only three of the Fishery Districts yielded oysters, namely Leith, Stornoway, and Ballantrae." Yet a Fishery Board for Scotland was established by statute in 1882, to "take cognisance of everything relating to the coast and deep-sea fisheries of Scotland." In 1799 oysters sold in Edinburgh from 8d. to 1s. per hundred (*Arnot's History*), whilst now the price is 1d. to 2d. each.

The Campaign in Tirah, 1897-98. An Account of the Expedition against the Orakzais, Afridis, under General Sir William Lockhart, G.C.B., K.C.S.I. By Colonel H. D. Hutchinson. With Maps, Plans, and Illustrations. London: Macmillan and Co., Ltd., 1898. Pp. xxi + 250.

Although this work is written as a history of the recent military operations in Tirah, on the north-western frontier of India, it contains much of geographical interest regarding a region which had not been previously visited by Europeans, but which has now been penetrated in all directions, surveyed, mapped, and supplied with a system of roads, so that it is no longer the *terra incognita* it was before the advance of the expedition. The campaign was undertaken in consequence of hostile acts committed by the tribesmen, whose attitude the author attributes to fear of British encroachment on their country, a fear induced by our attempt to demarcate, with the consent of the Amir, a definite boundary through it, which should establish responsibility for raids and outrages, including the right to intervene, restrain, and punish, with the Government of India on the one side, and with that of Afghanistan on the other. The tribesmen feared annexation, and fought for the independence they believed to be in jeopardy.

The country to be passed through by the force was known to be wild and mountainous, abounding in difficult passes and dangerous defiles; but after crossing the Arhanga Pass, and descending to Maidan at the head of the Bara river, the troops found themselves in an extensive and highly cultivated valley, capable of considerable development under a settled government. Here there are no villages, the houses, which are strong substantial buildings, capable of defence against musketry, being dotted all over the country at intervals of a quarter of a mile or so. A family or group of blood relations lives in each of these strongholds. The author's description of the march through the terrible Dwatoi defile, below Maidan, affords most interesting reading; "it is almost impossible to find words to adequately describe the difficulties of the road," which is, indeed, "a mere stony track

scrambling along the river bed, sometimes on the right bank, sometimes on the left, and as often as not in mid-stream, in ice-cold water up to the knees."

The book is well written, and is accompanied by seven maps and plans, and by twenty excellent illustrations.

Sunny Memories of an Indian Winter. By Mrs. SARAH H. DUNN, author of *The World's Highway.* London: Walter Scott, 1898. Pp. vii + 220. *Price 6s.*

Nothing particularly new as regards history, archæology, or ethnology is to be found in this pleasantly written volume, which, moreover, would be none the worse for the partial elimination of the numerous quotations, sometimes wrongly rendered, from Max Müller, Zoroaster, the Revelation of St. John, and other minor authors.

The descriptions of the native races and the temples are about the best part of the book, and though everything is viewed *en couleur de rose*, we are glad to notice a preference for the ancient Gothic over the Hindu style; the account of the Dravidian temples and their mysterious goddess with jewelled feet and hands, and the quaint reverence of the sacred elephants before the chief Brahmin is interesting, while the vivid description of the fairy beauty of the Jaina temples, some dating back over 1000 years, whose preservation is due to the care of them wisely enforced by the Government, will make those who have not yet seen them anxious for a glimpse of the loveliness so well portrayed. To Futteypor Sikri and Oodeypor an excellent guide will here be found, but the eternal snows of the Himalayas come in for the most powerful word-painting in the volume, though "vital loveliness" as applied to the hills does not appeal to us any more than "ardent beautifulness" in connection with the plains. Considerable space is devoted to the Parsis, but we do not quite follow the analogy between these ladies and "our own countrywomen of the last generation"; while the term "unrestricted," applied to the latter, would be more suitable to the girl of the period, to whom also the "characteristic and sympathetic songs" of Gujerati songstresses would probably appeal more were they translated into English than they would to the authoress.

It has been our fate, alas, to perform many night journeys in Indian trains, but on no line did we find the journey described in *Sunny Memories*, nor have we in any Pullman car at home suffered, as has the author, from an "exasperating official inspecting tickets at unholy hours of night"; though, possibly, to one whose enjoyment of night travelling is enhanced by "progressing at the brisk rate of ten miles an hour," from the time when the "silent white light of the Indian moon" had given way to the "yellow dawn of the Deccan," the Indian rail-ghari has its charms, but it is as well that the "pictorial groups of natives clothed and *un*-clothed, at each station," were veiled by that dim mysterious light.

Faulty genders and ill-spelt native words are more than compensated for by the real beauty of the illustrations which adorn the book, and the public is enriched by the possession of one more guide to some of the less-frequented parts of India, described by one well posted in her subject, and by whom the fatigues of the journey were little felt. Whether or no the "husband" to whom the volume is dedicated formed one of the party is not stated, but as the trip was taken in winter, the fair author cannot be said to have disregarded the excellent advice given on page 44 to "stick to your husband in hot weather."

Imperial Africa: the Rise, Progress, and Future of the British Possessions in Africa. By Major A. F. Mockler-Ferryman, F.R.G.S., F.Z.S. *Vol. 1. British West Africa.* With Numerous Maps and Illustrations. London: The Imperial Press, Limited, 1898. Pp. 489. Appendix and Index. *Price* 12*s.* 6*d.*

The Imperial Library is to consist of works giving information upon every subject concerning our great empire, "all designed to aid the noble movement now progressing for strengthening the ties which unite the mother country to the splendid colonies which are the power and the pride of 'Greater Britain' . . . to bring home to the minds of the millions of our splendid empire knowledge of what they as citizens of their huge commonwealth are so proud to possess." Major Mockler-Ferryman has been intrusted with the task of writing the first volume of *Imperial Africa*, and he has written upon British West Africa, of which he says in his preface he has endeavoured to supply the latest information, whilst at the same time he has done all in his power to fill in details suggested by persona knowledge which had been omitted by former chroniclers. "It is more as a simple work of reference than as anything else that I offer this volume to the public, though I venture to think that in it will be found many matters of interest to the general reader." The author regards West Africa as a valuable portion of the British Empire, and not as a white man's grave or a land of death, a description of the country which is so usual. In this connection he by no means ignores the high death-rate, but this he explains, and rightly, by the fact that the inertia of the officials and the short-sighted policy which obtained, but which we now believe have ended, have prevented the common-sense removal of the European residences to healthy areas twenty or thirty miles from the coast. Again, the men sent out have been ignorant of how to live, and, owing to the length of the coasting voyage to the various colonies, their health has deteriorated before ever they arrived at their posts. He says, "The sole idea of the young official or agent appears to be to get through his eighteen months as best he can, thinking only of the day when he will be homeward bound on six months' leave. He knows nothing of the various methods of settling down in a tropical country, and those who have gone before him have left him no legacies in this connection." He also calls attention to the fact that the officials do not wisely utilise their leave, and quotes a well-informed authority as saying that, "When the time comes to resume duty the young man is positively worse and not better for his visit to Europe. Once in England off duty they begin to dig their own graves."

It is not to be supposed that in such a short space the subject of West Africa could be dealt with in any great detail, yet Major Mockler-Ferryman has been fairly successful in dealing with the various colonies, with religion and missions, slavery and the slave-trade, political questions and with West African products. The illustrations are good, the maps satisfactory, and we have no doubt that th volume will answer the purpose for which it has been compiled.

Place-Names in Glengarry and Glenquoich, and their Origin. By Edward C. Ellice. London: Swan Sonnenschein and Co., 1898. Pp. 126. *Price* 2*s.* 6*d.*

This is a well-got-up volume of about one hundred and thirty pages, containin a short history of the district, many stories depicting the life and character of the people, an excellent map, and several illustrations.

The place-names are chiefly Gaelic, most of them being easily explained.

Others are difficult, and in many cases Mr. Ellice's derivations cannot be considered satisfactory—*e.g.*, *Loch Lochy* (given in Adamnan, 700, as Loch-dae and Nigra-dae) is, he says, Gaelic and Latin, but the name is more correctly derived by another writer from Celtic *Louka-déa*, the lost adjective *loch* "dark" and *dia* "a goddess," a root which we find in *Dundee*, *i.e. Dùn dia*, "fort or mound of the goddess," and in Glenlochy, near Killin.

Lochgarry he derives from Gaelic *garbh* "rough," but although *garbh* may be allied, it cannot be directly traced to it. The word is found in *Yarrow* (*Jharrow* 1426), *Yair* which gives *Yarmouth*, and probably *Mingary* and *Calgary* in Ardnamurchan and Mull.

The Gaelic orthography is weak, *oa* constantly written for *ao*, *na* ofetn for *nan*, and terminations in *i* where no *i* exists. The translation of Gaelic terms is occasionally faulty—*Blar*, "a peatmoss," given as "a green grassy field"; *Bac*, "a turf-pit or broken ground," as "a shoulder or ridge"; *Dail*, "a dale, field, or meadow," as "the name of a minor sept," a meaning it never has in place-names in Scotland; *Leac*, "a flagstone," correctly given in p. 10, but wrongly applied in *Meall Leac Claidh*; "the hill of the slope of treasure" should be "hill of the treasure stone." The derivations are in many cases too fanciful to be reliable; alternate derivations are bad, and while the stories given may fully account for the origin of many of the names, it must be remembered that it was customary in the Highlands to invent stories to account for names otherwise inexplicable. *Loch Hourn* (same as Loch Hourn in Lewis) is improbably derived from Gaelic *Iuthairn*, "hell," and equally doubtful is *Loch Loyne* from Gaelic *Loinn*, "beauty, comeliness." The exact local pronunciation of doubtful names would be of more value to the philologist than fanciful derivations. Mackinnon, "Place-Names in Argyll," and Alex. Macbain, "Place-Names of Badenoch, Norse element in Highland names, etc.," are excellent models of how place-names should be treated. There are several Fingalian names, and Mr. Ellice regards Fingal as a real historical person, a view which few of his readers will indorse.

On the whole, the book is a very good contribution to Highland place-names. It also contains an interesting history of Invergarry Castle—reference is made to iron-smelting works in Glengarry in 1727, and there is a graphic account of the great battle between the Lovats and Clan Ranald in 1544, a battle in which upwards of a thousand men engaged, of whom only twelve came out alive.

The book will well repay perusal, and the visitor and tourist to the district will find in it an admirable guide.

Apuntes Preliminares sobre una Excursion a los Territorios del Neuquen, Rio Negro, Chubut y Santa Cruz. De Francisco P. Moreno. *Revista del Museo de la Plata*, Tomo viii. La Plata, 1898.

The Director of the La Plata Museum, now geographical expert to the boundary commission, has since the year 1873 made numerous journeys to the less-known regions of the Argentine territory. In 1895 he determined to travel again over the southern parts of the western frontier, which he had visited in 1875 and 1880, and also parts he had not reached in his previous expeditions, and accordingly in January 1896 he set out with a large number of assistants.

In these pages he gives an account of explorations along the watershed or in the neighbourhood between lat. 36° and 46° 30′ S., over an aggregate length of about 4440 miles. Hundreds of points were determined astronomically, altitudes were observed, and numerous collections made. The region between the Rio Limay and the lakes Lacar and Nahuel-huapi has been mapped on the scale 1 : 400,000, an

exact plan has been drawn of Nahuel-huapi itself, and the Valle 16 de Octubre and other districts have been surveyed.

Dr. Moreno corrects many of the observations of the Chilian explorers, while some of his own have in turn been found incorrect by travellers on the western side. One of these seems to be the westward extension of the Lago de la Plata. Though Señores Arnsberg and Koslowsky explored it to its north-western extremity, it would appear from Dr. Steffen's exploration not to extend so far westwards as they supposed (see p. 486); no astronomical co-ordinates are given of the western extremity.

The most southern point reached by the expedition was on the bank of the great Lago Buenos Aires, perhaps the largest sheet of water in Patagonia after the Lago Viedma. Though not as beautiful as the Nahuel-huapi and Fontana, it is more imposing. The Rio Fenix, which formerly flowed to the Atlantic, has been cut off by a fall of stones so common in loose earth principally glacial, and now feeds the lake, the outlet of which is unknown, sending part of its waters along the old bed only during high floods.

This article of Dr. Moreno's should be read by all students of the geography of these regions. It contains tables of latitudes, azimuths, etc., and is accompanied by numerous good photographs and a map on the scale of 1 : 600,000.

Ergebnisse der Meteorologischen Beobachtungen im Jahre 1897. (Freie Hansestadt Bremen.) Herausgegeben von Dr. Paul Bergholz. Jahrgang viii. Bremen: Max Nössler's Buchdruckerei, 1898.

Dr. Bergholz's annual volume is compiled with great care and with great fulness, the observations being recorded for every hour of the day. Sunshine, clouds, solar halos, etc., are included.

Les Races Jaunes: Les Célestes. Par Edm. Planchut. Paris: Schleicher Frères, 1898. Pp. 224. *Price* 1 *fr.*

A prettily illustrated little book on one of the great subjects of the day, M. Planchut describes China and the Chinese with care and vivacity. "We must remember," he says, "that Nature has given to the yellow people of China frontiers which explain their isolation and justify their repugnance to open relations with the 'red devils' of the West. Whether we are black, brown, or fair, we are all 'red devils' to the Chinese. We owe this qualification to the fair-haired English. Thus the Chinese obtain a solitary revenge for their invaded capital, their pillaged palaces, their burnt arsenals and fleets, and that poisonous drug, opium, which slays them by thousands."

En Territoire Militaire. Par Louis de Grandmaison. Paris: E. Plon, Nourrit et Cie., 1898. Pp. 270. *Price* 3 *fr.* 50.

Having served for more than two years in the Langson district, the author, a captain in the 131st Infantry, discusses the questions of (1) What took the French to Tonkin; (2) What they have done there; and (3) Why they have failed. He is of opinion that his countrymen "colonise very badly. All our efforts at expansion bear traces of decrepitude, fatigue, and inability to produce anything. After myself practising colonisation and living in contact with natives, I have arrived at the conclusion that moral forces alone, unfortunately too much despised, can impart vitality to our enterprises. I insist that we must return to our traditions and national methods. The British are organisers of the highest class, and we ought

often to take lessons from them. . . . I thoroughly agree with Edouard Drumont's statement in a recent article on Anglo-Saxon superiority: 'If the British are at this moment so superior to us, it is not because they are Britons but because we have ceased to be Frenchmen.'"

Through the Yang-tse Gorges; or, Trade and Travel in Western China. By Archibald John Little, F.R.G.S. London: Sampson Low, Marston, and Co., 1898. Pp. xix + 315.

Though this is the third edition of this well-known book it contains much that is new. An introductory chapter on the British Sphere of Influence treats of the prospects of trade in the rich Yang-tse valley, and another important and interesting addition is the narrative of the first voyage of a steamer to Chung-king. Mr. Little has made himself a name by the energy and perseverance with which he has struggled against Chinese officialdom to open up the navigation of the Yang-tse. Last spring he had the satisfaction of taking a steamer through the gorges; and though the trip was not a complete success, inasmuch as trackers were sometimes needed, Mr. Little may be proud of having led the way, and shown that a more powerful steamer of lighter draught could probably make the passage without serious difficulty.

Questions du Temps Présent.—L'Éducation et les Colonies. Par Joseph Chailley-Bert. Paris: Armand Colin et Cie., 1898.

A perusal of this little pamphlet can hardly fail to arouse wonder and even amusement in the minds of English people, who have been accustomed to deal with colonial problems for many generations. If we are to take Monsieur Chailley-Bert seriously, the most elementary questions in connection with the development of the colonies have hardly been studied, not to speak of being solved, in France. Hence it results that the conclusions at which Monsieur Chailley-Bert, after much discussion and consideration, arrives, are to us mere commonplaces with which we have long been familiar; and we can only hope that now that attention has been roused in France to the wisest methods of developing the colonies and equipping the colonists of the future, the matter will not be allowed to rest there, but that some practical results, beneficial both to the colonies and to France, will be achieved. The writer puts his finger on the most serious difficulty of the present system, viz. the law of military conscription, which sends to the barracks and drill-ground, for one or even three years, young men just at the time when they should be under training for a colonial career. Until this is modified, if not repealed, it is hard to see how the practical training which Monsieur Chailley-Bert deems imperative can be imparted.

Ustica. Prague: Heinr. Mercy, Sohn, 1898. Fol. Pp. 130.

In this magnificent volume the illustrious author who described the Lipari Isles elucidates in the same masterly manner all the details of the island of Ustica off the north-west coast of Sicily, and distant thirty-seven and a half miles from Palermo. Never was island more fortunate in having its history, resources, dialect, scenery, and geography published to the world with all the ability of the author and all the advantages which splendid paper, type, and illustrations afford. We note that the author remarks: "Geographically, Ustica does not belong to the Lipari Islands, although geologically it forms a continuation of the Salina-Filicuri-Alicuri line, and its rocks belong to the same group as theirs."

The Study of Man. By Professor Alfred C. Haddon, M.A., D.Sc., M.R.I.A. ("The Progressive Science Series.") London: Bliss, Sands, and Co. New York: G. P. Putnam's Sons, 1898. Pp. xxxi + 512. With many Illustrations. *Price* 6*s*.

Although Professor Haddon intimates that he has written this work "for the amateur and for that delightfully vague person, the intelligent reader," it cannot fail to prove of great interest to all who concern themselves in the various phases of Anthropology. Comprehensive in scope, it deals not only with Man himself, as regarded structurally, but also with many of his customs and traditions, all of which have a distinct bearing upon the main theme. In the first five chapters the amateur will obtain much scientific information on Anthropological Measurements, on Hair and Eye Colour, on the Value of Head-Form and the varieties of the Human Nose, and on the Ethnography of the Dordogne District. Passing from these severer forms of study, he will then peruse with the liveliest zest the succeeding chapters on such subjects as Children's Games and "The Evolution of the Cart," which occupy the greater part of the book; and he will realise therefrom to what an extent a skilful and competent examination of apparently trivial customs and objects will yield results which throw light not only upon our own past, but upon the many other interlinked races of mankind. Occasionally—one could wish it were more frequently—Professor Haddon draws upon his own experiences among the native tribes of New Guinea and Torres Straits, with regard to whom few living anthropologists have so intimate an acquaintance; and these more personal references give an added vivacity to his descriptions, attractive as these are notwithstanding. Thus, in the course of a sketch of those localities in the Far East, where our familiar game of "cat's cradle" is equally at home, the reader takes a still livelier interest in the question when the author relates how he found that the game was quite well known to a little black native of an island in Torres Straits. Of this game, it may be mentioned that Professor Tylor thinks it probable that it found its way from South-East Asia into Europe, where it does not appear to be of any high antiquity. In this connection it may be added, as a fact not generally known, that the paper kite is also "a comparatively recent plaything in Europe, having been introduced in the course of Oriental trade from the Far East during the seventeenth century," which, by the way, may account for the name of "dragon" commonly given to a kite by country boys in eastern Scotland, presumably from the emblems on the earliest importations from China.

The book concludes with a chapter of "Practical Suggestions for conducting Ethnographical Investigations in the British Islands," from which any amateur who has read the preceding chapters will learn how to put into practice the ideas and aims which Professor Haddon's treatise cannot fail to have aroused within him. Altogether, the work is an admirable instance of how Science, in the hands of a bright and accomplished scientist, may be made highly attractive and interesting even to those who had previously regarded such matters as dull and "dry."

Die Heimath der Homanen (Indogermanen) IV. Von Schwerdtfeger. *Cruttinnen: Selbstverlag des Verfassers*, 1898. Pp. 36.

It is still a matter of dispute whether the original home of the Indo-Europeans was in Europe or Asia. The author comes forward as a strenuous advocate of the former hypothesis. In his opinion great *steppes* and boundless prairies are not the places where the domestic animals, once in a wild state, could be readily tamed

and kept. He maintains that this would be accomplished more successfully in the luxuriant meadows that border rivers in the low country. The steppes in Asia and the south of Russia were, therefore, quite unsuitable for the Indo-European stock-breeders, who, moreover, lived on the whole a sedentary life, and were only nomads under press of circumstances. Hungary, he thinks, may have been the original centre from which the Indo-Europeans or Homans, as he is pleased to term them, gradually spread to the coast lands of the North Sea in one direction, and down the Danube in another, till eventually their tribes covered the whole of Europe.

When the author applies himself to the explanation of place-names, he shows that his philological ideas are not in advance of those current at the beginning of the century. The ethnic name "Usipetes" he explains by Vispats "lords"; the termination *nissa* in Vindonissa, now Windisch, is the Slav *nizh*, "low"; and Parthanum, now Partenkirchen, is the Slav *horod na hum*, "the ford on the height"!

Yet, apart from these eccentricities, some of the author's remarks are not without interest, though his presentation of the subject as a whole is far from lucid.

The Union of Italy, 1815-1895. By W. J. Stillman. ("Cambridge Historica Series.") Cambridge: University Press, 1898. Pp. 412.

Having been for some time correspondent of *The Times* in Rome, the author has studied with care, and now expresses with impartiality his opinion upon, Modern Italy. He reminds us that the regeneration and unity of Italy are due to the influence of Britain, France having always, from Richelieu downwards, "considered the erection of Italy into a strong and united nation as a menace to French predominance." Whilst Britain regarded Italy as a friend, France desired to have her for a vassal, and even when France defeated Austria in 1859 she betrayed Italy. The author considers that the unity of Italy has been achieved too quickly, and that it would have been better to have waited many more generations in order to fulfil the prophecy, *Italia fara da se*, than for Italy to have been helped a single step by France. He pictures the present deplorable political condition of Italy in the following graphic passage: "The animosities of the factions, and the corruptness of the agencies which have by this time pervaded all branches of the Italian Government, have developed a discontent with, and even a contempt for, parliamentary institutions, which is at this moment the greatest danger in the condition of the nation. The wisdom of Garibaldi and Crispi in insisting, though fruitlessly, on the separate government of the southern provinces until they should have become more fit to take part in governing themselves has now become clear. Southern corruption, the Camorra, and the insubordination of the Neapolitan provinces, as well as the lawlessness of the Sicilian population, half controlled by the Mafia, have penetrated the national Government. On the one hand, the northern provinces, especially Piedmont, Lombardy, and Tuscany, are revolted by the abuses imported from Naples and the Papal States, and by the brigandage still lingering there and compromising the reputation of Italy, as well as alarmed by the perils contained in the condition of Sicily; on the other, the southern provinces, under a lax and inert Government, are incapable of keeping pace with Northern Italy in prosperity or order, and rebel against the restraint which the northern provinces would impose on them. A dispassionate observer can hardly fail to see that Italy tends towards a dissolution, rather than a consolidation, of her unity; but the federal system, which is the aspiration of Italian Radicals, would inevitably bring

about the destruction at once of the monarchy and of the coherence of the State. It would have been, as a preliminary condition, a healthy step towards unity; as a retrograde measure, it would be the prelude of disorganisation and anarchy.

The Guide to South Africa, for the use of Tourists, Sportsmen, Invalids, and Settlers. Edited annually by A. Samler Brown and G. Gordon Brown. 1898-99 edition. London: Sampson Low, Marston, and Co., Ltd, 1898. Pp. xliv + 420. *Price* 2*s.* 6*d.*

No change of importance has been made in the current volume of the Castle Line Guide, but small improvements and additions have been made here and there. One of these is a large general map of South Africa. The book contains a large amount of information without being too bulky.

Madeira and the Canary Islands. A Practical and Complete Guide for the use of Invalids and Tourists, with sixteen coloured Maps and Plans, and numerous Sectional and other Diagrams. By A. Samler Brown. Fifth and Revised Edition. London: Sampson Low, Marston, and Co., Ltd., 1898. Pp. 346. *Price* 2*s.* 6*d.*

It is no economy on the part of author or publisher to send out a new edition of a guide-book which is not thoroughly overhauled and re-invigorated with the latest information. And, no doubt, it is partly because this little handbook is kept so well up to date that it has gone through so many editions. The author as a guide-book writer has the exceptional faculty of foreseeing all the wants of the tourist and invalid, and anticipating all their inquiries, even to satisfy the most troublesome and fastidious. A desirable feature is the Bibliography of all the literature relating to the islands, but the Guide is so complete in itself that few tourists are likely to have recourse to further authorities.

Hazell's Annual for 1899. A Cyclopædic Record of Men and Topics of the Day. Edited by W. Palmer, B.A. London: Hazell, Watson, and Viney, 1899. Pp. 676. *Price* 3*s.* 6*d.*

The new volume of this useful annual has recently appeared. There are useful and accurate articles in it on geographical or closely allied subjects, such as those on China, the Niger, Sudan, etc., and several biographies of special interest at the present time. It is an almost indispensable book of reference.

Pictorial and Descriptive Guide to the Channel Islands and the adjoining Coast of France. London: Ward, Lock, and Co., n.d.

The above guide-book seems to contain all the information regarding the Channel Islands that is required by the ordinary tourist. The section on Normandy and Britain is rather meagre. The maps are rough, but serve their purpose.

Rhodésie et Transvaal. Par Albert Bordeaux. Paris: Plon, 1898. Pp. 284. *Price* 2 *frs.*

In June 1895 the author sailed to Beira, and from thence proceeded to Salisbury in Rhodesia. Buluwayo and Matabeleland, the ruins of Zimbabwé, Pretoria and Johannesburg, the Jameson Raid, the sources of the Sabi, and the goldfields of South Africa, are treated of in interesting and instructive chapters, illustrated by excellent views from photographs.

NEW MAPS.

THE WORLD.

THE NAVY LEAGUE MAP, illustrating British Naval History.
W. and A. K. Johnston, Edinburgh.

The important part of this large wall map is that representing the oceans, with British naval stations, etc. A quantity of statistical, historical, and other information is printed on the sheet.

EUROPE.

HONGRIE. Carte Postale et Télégraphique des Pays de la Couronne de ——. 1898. Échelle de 1 : 576,000. *Presented by J. Y. Buchanan, Esq.*

AFRICA.

RIO DEL REY UND CROSS RIVER (MANYU). Das Deutsch-Englische Grenzgebiet, zwischen ——, hauptsächlich nach den Aufnahmen des Premierlieutenant von Besser. Konstruirt und gezeichnet von Dr. Richard Kiepert und Max Moisel. Massstab 1 : 150,000.
Mittheilungen aus den Deutschen Schutzgebieten, Bd. xii. *Heft* 3.

ATLASES.

THE CITIZEN'S ATLAS OF THE WORLD. Edited by J. G. Bartholomew, F.R.G.S. *Price* 16*s.* *George Newnes, Limited, London.*

This collection of ninety maps should find a brisk demand. It is convenient in size, cheap and up to date ; the maps of Africa and India are particularly good. The volume also contains a full index and other useful letterpress. The chapter on The Commodities of Commerce, and the page of Geographical Etymology need a few slight corrections and improvements.

THE COMPARATIVE ATLAS, Physical and Political. By J. G. Bartholomew, F.R.S.E., F.R.G.S., and edited by J. M. D. Meiklejohn, M.A., F.R.G.S.
Alfred M. Holden, London, 1898.

The above collection for schools consists mainly of maps in pairs, showing respectively the physical features and the political divisions, towns, etc., of the country represented. This system should have been carried further. A new feature are maps of the density of population in the chief commercial and industrial districts of Great Britain. A few instructions to students in map-drawing are contributed by Professor Meiklejohn.

ATLANTE SCHOLASTICO, per la Geografia Fisica e Politica. Di Giuseppe Pennesi. *Prezzo L.* 6. Roma, 1898. *Istituto Cartografico Italiano.*

We have once or twice before noticed this excellent atlas. The new edition contains a few additional sheets, while, at the same time, the price is reduced. Probably the new boundaries of the Niger Territory and Somaliland were fixed too late for insertion, but the Togoland frontier was defined last year. Siam still retains in the atlas its old boundaries, as they were before the treaty of 1896.

THE SCOTTISH

GEOGRAPHICAL

MAGAZINE.

THE EGYPTIAN SUDAN.

(With a Map.)

Exploration.

Bilad (or Beled)-es-Sudan signifies the land (or lands) of the Blacks, and is properly applied to the part of Africa occupied by the Negro race, from the Nile to Senegambia and the Guinea coast. The Egyptian Sudan, the territory subjugated by Mehemet Ali and his successors, is, properly speaking, a purely political division, for it includes many districts now inhabited by tribes of Arab or mixed race. It extends from Wadi Halfa southwards to the Albert Nyanza; on the east it embraces Suakin, Massaua, Kassala, and Sennar, and in the provinces of Darfur and the Bahr-el-Ghazal extends into the valleys of the Shari and the Welle. Berbera and Zeila were also under the same administration, and the Egyptian Government laid claim to the intervening country between these coastal towns and Sennar, as well as to Unyoro, but never effectively took possession of them. Massaua is now an Italian possession, and Berbera and Zeila with their hinterland and Unyoro have passed into the hands of the British Government.

The ancients had no definite knowledge, it may be said, of the upper valley of the Nile. Herodotus ascended the river to Aswân, and mentions the great Ethiopian kingdom of Meroe, and the town of the Automoloi, deserters from the army of Psammetichus, which he places as far beyond Meroe as the latter is above Aswân; but he can give no description of the country. Early in the Christian era Nero despatched an expedition up the Nile, which reported that its upper part was swampy, and that the bed was full of mud and herbage, just as the Nile is above the Sobat. Ptolemy represents the Nile as flowing out of two lakes fed by streams descending from the Mountains of the Moon, and the Astapus (the Blue Nile) flowing out of Lake Colue, the modern Tana. His map and those of his immediate successors, as well as the geographical theories of the

Arabs and Portuguese explorers, are discussed by Mr. Ravenstein in *The Lake Region of Central Africa* (vol. vii. p. 299), where he shows how little accurate information about the Upper Nile was obtained until comparatively recent times.

Saladin and other Arab leaders made campaigns into Nubia, and Jesuit missionaries in the seventeenth and the beginning of the eighteenth centuries penetrated to the upper course of the Blue Nile either from Nubia or Abyssinia. Poncet travelled through Sennar to Gondar in 1699, and Duroule reached Sennar in 1704, while Pedro Paez, who resided in Abyssinia early in the seventeenth century, was the first European to visit the sources of the Blue Nile. He was succeeded in 1770 by James Bruce of Kinnaird, who travelled from Massaua to Gondar, and then traced the Abai, the principal headwater of the Blue Nile, from its source through the Tana lake, and returned home by Sennar and the Nile valley. Darfur, on the western side, was visited by W. G. Browne between the years 1792 and 1796. Being unable for three years to escape from the country, he had many opportunities of hearing reports of the adjacent countries. Thus he mentions copper mines (Hofrat-en-Nahas), and describes the trade-routes to the west; but of the upper White Nile, the Bahr-el-Jebel, he has no exact information. In 1814 Burckhardt ascended the Nile to Shendy, and crossed the desert to Suakin.

Travellers found more easy access to the Upper Nile when the Egyptian Government commenced to extend its authority into this region. In 1820 Mehemet Ali sent an expedition under his son Ismail, ostensibly to pursue the Mamelukes who had retreated to Dongola, though his real object was to recruit his army from the Negroes of the Upper Nile, where, too, Sennar, with its reputed wealth in gold, presented a great attraction. The Mamelukes were quickly dispersed, some under Abd-er-Rahman taking refuge in Darfur, and others turning towards the Red Sea. But Ismail continued his march in 1822 southwards to Sennar, which internal dissensions rendered an easy prey to his army, and with his brother Ibrahim ascended the Blue Nile as far as Fazokl, while Mehemet Bay, the Defterdar, marched into Kordofan. On his return Ismail and his followers were burned to death at a feast by the ruler of Shendy, and his death was speedily avenged by the Defterdar, who hastened from Kordofan immediately on hearing of the massacre.

In 1838 Mehemet Ali visited the Sudan in person to inspect the gold placers in Dar-Fazokl. At Khartum, which was founded in 1820, and named after the Ras-el-Khartum, or Elephant's Trunk point, where the Blue and White Niles meet, he was seized with a desire to explore the latter branch, especially in the hope of finding gold. In 1827 Linant de Bellefonds had ascended the White Nile as far as 13° 43′ N. lat., and had established the fact by actual measurement that it carried a larger volume of water than the Blue Nile, which Bruce held to be the main stream. The first expedition sent out, in 1840, by Mehemet Ali under the command of Selim Bimbashi, who was accompanied by the Frenchman Thibaut, advanced as far as 6° 35′ N. lat.; the second, in the same

year, in which Thibaut, Dr. F. Werne, and the engineers D'Arnaud and Sabatier Theil took part, reached the fifth parallel; a third expedition was not so fortunate. By the enterprise of Mehemet Ali the provinces of Kordofan, Sennar, and Taka (Kassala) were added to his dominion, and the information acquired during the expeditions up the White Nile stimulated the desire for further exploration.

Soon traders began to send out parties to develop the commerce of the countries disclosed by the Government expeditions, the first being fitted out in 1843. Two years later the Sardinian Consul, Brun-Rollet, equipped a large expedition, and established at Belinian, in the Bari country, not far from the site of the future Gondokoro, a station for the ivory-trade. As the stores held by the native chiefs were before long exhausted, ivory became more difficult to procure, and many of the traders resorted to the more profitable trade in slaves, establishing zeribas with armed garrisons on the tributaries of the Nile. Others sought to obtain larger supplies by penetrating farther into the unknown districts, and thus acquired fresh geographical information, and led the way for scientific travellers. Chief among these was John Petherick, who travelled up the White Nile as far as Faloro, and subsequently in the years 1853-58 made expeditions in the Bahr-el-Ghazal basin, marching southwards from Meshra-er-Rek to Mondu in the Makraka country, which he supposed to lie on the Equator. Again in 1862-63 he made an excursion into the Rohl valley.

In 1861-2 Sir Samuel Baker spent next twelve months in exploring the sources of the Nile descending from Abyssinia. At the end of 1862 he started from Khartum up the White Nile, and met Speke and Grant, who had discovered the Victoria Nile, and from whom he heard a report of the existence of the Mwutan Nzige. Sir Samuel Baker marched into Unyoro, and traced the Nile from the lake to the Murchison Falls. At the end of 1869 he again visited the Bahr-el-Jebel, being commissioned by the Khedive to suppress the slave-trade: and in 1872 made a march into Unyoro, where he established a station at Masindi.

Meanwhile Th. v. Heuglin and the Tinne expedition had explored, during the years 1862-64, the northern part of the Bahr-el-Ghazal district. Another remarkable traveller was Giovanni Miani, a Venetian, who first visited the Upper Nile in 1859. On one occasion he was only sixty miles from the Albert Nyanza. He died in 1872 at Munza's village, in Monbuttu. Unfortunately many of the notes of his journeys were lost, and he is best known through the two Akka dwarfs he sent to Italy. A few years earlier, 1868-70, Dr. Georg Schweinfurth reached the same part of Africa, crossed the Niam-niam country to Monbuttu, and also travelled westward through the Golo country to Bia and Nduggo. He also first brought into notice the river Makua or Welle, so long a subject of discussion.

Ernst Marno in the years 1870-72 made surveys of the Nile, Bahr-el-Ghazal and Bahr-ez-Zeraf, and visited Kordofan. With the arrival of General Gordon at Khartum in 1874 the Egyptian Sudan entered on a more progressive period. Darfur, which had fallen into the hands of the notorious Zubehr, was annexed in that year, and two scientific

expeditions, under Colonel Purdy and Colonel Colston, were sent out to report on the capabilities of the country. Gordon himself proceeded to Gondokoro, where a station had been established by Baker. Within the next two years he had erected a line of stations from Lado, which he made the headquarters of the province, to the Albert Nyanza. He also conveyed two steamers in sections from Muggi to Dufile, above the cataracts. On one of these, the *Khedive*, Gessi, accompanied by Piaggia, who in 1863 had visited the Upper Welle, circumnavigated the Albert Nyanza in 1876, and ascertained that its dimensions were far smaller than Baker had supposed. In the same year Dr. Emin Effendi was sent as Gordon's representative to Mtesa, king of Uganda. The year of Gordon's arrival, 1874, Dr. Nachtigal arrived in Darfur from Wadai, and passed on to Khartum.

Gordon, who had left Egypt in 1876, returned again in February 1877 as governor-general of the Sudan, the Red Sea provinces being included in his jurisdiction, so that he ruled over a territory some 1640 miles long by 660, on an average, in breadth. With the object of settling differences that had arisen with the king of Abyssinia, he travelled to that country through Massaua, and having visited Bogos, Kassala, and Gedaref, reached Khartum through Sennar. No sooner had he reached the capital of his government than he was called to Darfur by a revolt, headed by a relative of the late Sultan, and by the threatening attitude of Suliman, son of Zubehr. Having crushed the revolt and sent Suliman into the Bahr-el-Ghazal province, he returned to Khartum and again visited the Abyssinian frontier, where fresh troubles had broken out, and also Harrar and Zeila. Meanwhile, in 1878, Suliman rebelled again, and Gessi Pasha was sent against him, who took Dem Suliman by assault, and induced Suliman to lay down his arms. In 1880 Rauf Pasha succeeded Gordon as governor-general, and the following year the Mahdi insurrection broke out, which resulted, as is well known, in the loss of the Sudan and the assassination of Gordon at Khartum in the year 1885.

During the years that Gordon administered the Sudan the officers under his orders added much to the geographical knowledge of the country, Gessi Pasha, in his capacity of governor of the Bahr-el-Ghazal, and his successor, Lupton Bey, travelling over their province, and Emin Pasha, who was appointed in 1878 governor of the Hat-el-Estiva, or Equatorial Province, commencing the scientific observations, which he continued down to 1889, when he left for the east coast with Stanley. With him Lupton, appointed deputy-governor in 1879, travelled through the Bari, Latuka, and Shuli countries. Besides these official explorers, geography owes much to Major Gaetano Casati, who went out to the Equatorial Province in 1880, travelling through the east of the Bahr-el-Ghazal Province and Monbuttu, and resided with Emin Pasha from 1883, returning with him in 1889. He also went to Unyoro to negotiate on Emin's behalf with the king of that country.

In the Monbuttu country Casati met the famous Russian traveller, Dr. Wilhelm Junker, then on his second journey in the interior of Africa, which lasted from 1879 to 1886. In 1876-78 he had made

his way inwards by the Khor Baraka, never previously investigated, from Kassala had proceeded *viâ* Gedaref and the Atbara to Khartum, ascended the Sobat to Nasser, visited Lado and travelled to the Wau through the Rohl country and back to Kakuak and Kalika. In 1879 he crossed from Suakin to Berber, and travelled by the Bahr-el-Ghazal and Dem Suliman into the A-Zandeh or Niam-niam country. Here he remained till 1883, making excursions in various directions and tracing the river, known in different parts of its course as the Kibali, Makua, Welle and finally Mobangi, as far as Ali Kobbo's. Then, finding his retreat northwards cut off by the Mahdists, he betook himself to Emin Pasha at Lado, and in 1886 travelled through Uganda to the east coast.

Richard Buchta also travelled in the country west of the Bahr-el-Jebel in 1879, and Dr. Felkin and the Rev. C. T. Wilson on returning to Uganda were forced to diverge westwards, as the Nile was blocked by *sudd*, passing through the Bahr-el-Ghazal, Darfur, and Kordofan.

Except the journeys made by Emin Pasha in his province down to his departure in 1889, exploration in the Sudan was prevented by the Mahdi revolt until recently. In 1896 the Bottego expedition crossed the tributaries of the Sobat, and last year Captain Marchand led his expedition from the Mbomu valley to the Sueh river, and navigated the latter to the Bahr-el-Ghazal and Fashoda on the White Nile. Another Frenchman, M. de Bonchamps, reached the Baro, or Upper Sobat, from Abyssinia, and traced it down nearly to Nasser, the highest point reached by Dr. Junker.

Geographical Sketch.

The Egyptian Sudan lies almost entirely in the Nile basin. Darfur, however, is nearly bisected by the watershed between the Bahr-el-Arab and the Shari, and the governors of Bahr-el-Ghazal and Hat-el-Estiva exercised control over a large portion of the Welle basin, which perhaps may not be reclaimed. On the eastern side Harrar and Somaliland were not long in the possession of Egypt, and Massaua was ceded to Italy, so that here only the Baraka valley and the Red sea littoral lie outside the drainage area of the Nile.

On the south-east the basin of the great river is bordered by the inland drainage basin of the lakes Rudolf and Stephanie, 1200 feet above sea-level. Between this and the upper Nile the country has yet to be fully explored. The most easterly chain seen by Emin Pasha lies between 33° and 34° E. long., and is called Lirem in its southern portion and Irenga in its northern, which extends up to 5° N. lat. It is succeeded on the west by the Lafit-Logere chain, separated by the Khor Tu. South of 4° N. lat. those chains unite and extend westwards and north-westwards in flat-topped elevation about 3500 feet in height, skirting the western side of the broad Khor Kohs valley, and send forth a prolongation, the Lokoya mountains, to the neighbourhood of Gondokoro. These mountains, as far as is known, consist of granite, with red clay in the valleys sometimes alternating with sand. The valleys are fruitful and the heights well wooded and abundantly stocked with game. In the south-western part of these highlands the Asua

flows north-westwards to the Nile in the rainy season; in the dry season it carries no water. The Tengri also and other khors more to the west contain only pools in the dry season.

North of the Rudolf and Stephanie basin, the basin of the Nile, here drained by the affluents of the Sobat, is confined by elevations running to meet the highlands of Abyssinia, where the Blue Nile flows from mountains that rise to 15,000 feet (4600 mètres) above sea-level. Northwards the boundary runs into Nubia, a desert plateau intersected by the bed of the Nile. Near the coast it has elevations of nearly 5000 feet (1500 m.) in some parts, and then it sinks gradually to the Nile. On the west the Libyan plateau rises steeply, but sinks rapidly again to the hollow in which the Egyptian oases succeed one another from north to south.

To the sources of the Sobat and the Blue Nile the breadth of the drainage area to the west of the main stream may be as much as 300 miles, while in the north of Abyssinia it contracts to not much more than 200.

On the western side of the Nile, where it issues from the Albert Nyanza, is a range of mountains discovered by Junker, the summits of which, over 6000 feet (1800 m.) high, he named after noted explorers of these regions. The watershed here runs northwards with an elevation of fully 4000 feet (1200 m.) as far as 3½° N. lat., where it turns suddenly north-westwards, the mountain chains at the same time splitting up into numerous small ranges and groups of hills, and the maximum elevation finally sinking below 2000 feet. On reaching the intersection of the fourth parallel with the meridian of 30° E. long. it runs for half a degree northwards and then turns south-westwards across Jebel Baginze to the twenty-eighth meridian, where it again directs its course north-westwards, soon after crossing the fifth parallel and entering the ranges of Pambialand a little south of the sixth parallel, through which it proceeds to the sixth parallel and the twenty-sixth meridian. Running then northwards to the eighth parallel it bends westwards, meeting the Shari basin at about the twenty-third meridian. The sources of the Kibali on the western slope of the mountains north-west of the Albert Nyanza, between 2½° and 3½° N. lat., lie at an elevation of 4600 feet (1400 m.); in the neighbourhood of Baginze and Wando the elevation of the watershed is about 3300 feet (1000 m.), while from Wando to the vicinity of Dem Suliman it seldom exceeds 2300 to 2600 feet.

The country sinks from the thirty-first meridian gently to the Nile, dotted over with a few hills. The tributaries are unimportant, the largest being simply khors, as the Ayu descending from the bend of the watershed, and the Lurit, which enters the main channel nearly opposite Gondokoro. There is, however, one exception, the Kya or Kiju, joining the Nile between Bedden and Kiri, which has always water. The watershed between these and the Yei is an irregular elevation with several prominent heights which at length terminates in two well-defined ranges, Jebel Mira and Jebel Reko, rising 1300 feet (400 m.) above the surrounding country, and containing the sources of the Gel, which enters the Nile below Bor. Westward of the thirty-first parallel the land falls from the watershed, here consisting of flat ridges or

plateaus, fairly regularly to the lowlands of the Nile basin, the edge of which runs from Lado to Jur Ghattas. The slope is undulating in consequence of the action of water on the soil which is principally laterite. The rivers and brooks have cut deeply into the ground, and the intervening ridges have been again divided transversely. On this base rise domes and hills of various size, blocks of stone and heaps of detritus, principally of gneiss. As a rule these elevations have a relative height of not more than 500 feet, but in a few localities they are more extensive and loftier, while isolated summits of considerable height are found at the edge of the flat land and even within its bounds, such as the Jebel Rejaf and Jebel Lado, the latter nearly 1000 feet (300 m.) above the river.

One of the most marked features in the watershed is the mountain Baginze, already mentioned. It rises, according to the estimate of Schweinfurth, who ascended it, to a height of about 4700 feet (1430 m.) and is composed of gneiss exceedingly rich in mica and containing a large quantity of cyanite crystals. From it the headwaters of the Sueh, the Upper Jur, take their rise, and not far to the east, in Makraka, rise the Issu (Tonj), Jau, and Rohl. To the north-west, beyond the upper tributaries of the Sueh, lie the Pambia mountains, stretching northwards for thirty miles, and probably once intimately connected with the Abu-Shatter and other mountains beyond the sixth parallel. Round the sources of the Wau the watershed is represented by the Nbia Bandiri, the Nbia Dagarumba, and Makamba, composed of granite. The country is undulating, and loose stones or granitic debris cover the plateaus between the streams. The soil is everywhere impregnated with iron, the hills are covered with bush and clumps of trees. At the eighth parallel the watershed reaches its maximum distance from the White Nile, about 600 miles. While the mean height of the watershed gradually diminishes, the land through which flow the upper waters of the Bahr-el-Ghazal and Bahr-el-Arab rises, so that the slope down to the flat land is steeper than in the eastern part of the Bahr-el-Ghazal basin.

The middle of Darfur is occupied by the Marra mountains, a hundred miles from north to south, with a breadth of sixty miles, and joining the Bahr-el-Ghazal and Congo watershed. Its mean height varies from 1000 to 1500 feet (300 to 450 m.), above the plains, which on the south-west are 4000 feet above sea-level, while its highest summits attain to 6000 feet of absolute height. It sends off a number of streams to the Bahr-el-Arab and Shari through fruitful valleys well covered with clay and vegetable soil. On the northern side lie a multitude of outlying summits, forming innumerable valleys with very slight slopes, where the stony and sandy soil soon soaks up the water. Beyond, and also eastwards towards Kordofan, stretches the desert. Two and a half days' march through country where no wells exist lies between the eastern boundary of Darfur and Kordofan. Eastwards the country falls towards the Nile, but very gently, the country consisting of a tableland rising to a maximum altitude of a little over 2000 feet (600 m.), uninterrupted by any mountain chains. A few isolated peaks in the south look down on the plains from a height of not more than 1350 to 1850 feet. The steppes of Kordofan lie between 1360 and 1850 feet above sea-level. The most prominent

elevation is the group of Jebel Daier, rising 1000 feet above the plains and presenting a lofty, unbroken front on all sides. The soil of Kordofan is granite sand mixed with clay, which predominates more and more towards the south, so that towards Dar Nuba there are wide areas of forest country covered with a rich black mould.

Dar Nuba, south of Kordofan, has a totally different character, being traversed by chains of hills in all directions, with intervening plains and valleys, where vegetation of all kinds grows luxuriantly. The rain is abundant and is drained off into the Birket lake, the khor Abu Habl, which loses itself in the sand, and into the Bahr-el-Arab. The fauna also is rich and varied.

The basin of the Nile, therefore, from the Jebel Marra to the Sobat is surrounded by granite formations, exhibiting the signs of extensive erosion which has filled up the lowlands, probably a vast lake originally, with a thick deposit of laterite through which the lower courses of the rivers wind with sluggish currents.

The Nile, under the name of Bahr-el-Jebel, issues from the Albert Nyanza at a height of about 2300 feet (700 m.), and flows for 135 miles in a deep, broad stream with very little fall to Dufile. It then becomes troubled, and at the Fola falls, two and a half miles below Dufile, rapidly changes its level. Several rapids succeed down to Kiri, whence a stretch navigable by boats extends down to Bedden, where another rapid interrupts its course, which is the last permanent and (generally) impassable obstacle until the sixth cataract at Shabluka below Khartum is reached. At Regaf the river is 7 feet deep at low water and 15 in flood, discharging 500 to 1600 tons of water per second. From Regaf to Bor, 112 miles, it is still rapid, after which point to the junction of the Bahr-el-Ghazal, 316 miles, it meanders in numerous marshy channels, sometimes completely blocked with sudd. Twenty-three miles north of Shambe branches off to the east the most important of these lateral channels, the Bahr-ez-Zeraf (Giraffe river). It is very winding, flowing through flat, marshy country intersected by innumerable channels and diversified with forest, and is generally blocked with sudd. It rejoins the main stream twenty-eight miles west of the mouth of the Sobat.

The Bahr-el-Ghazal joins the Nile at the lake No or Mogren-el-Bohur. The lake varies in area, being in summer about sixty square miles. As a rule, the Bahr-el-Ghazal has a feeble discharge and the channel is encumbered with vegetation, so that the traveller passing its mouth is apt to underrate its importance; when in flood it occasionally has a larger volume than the Nile. The Sobat also has a discharge in summer nearly equal to that of the Nile, but in winter becomes insignificant, and sometimes even quite dry. Here the river becomes the Bahr-el-Abiad, or White Nile, and down to Omdurman, 505 miles, receives no affluents, except a few khors which contribute small streams of water in the rainy season. The Nile is high at Khartum for about a month from the end of August or beginning of September, while the river is lowest in April. The Blue Nile flood is at its height about August 25th, when it discharges about 8000 tons of water per second (280,000 cubic feet), which is about that of the White Nile, but from

November to March the latter is the chief source of supply. The average difference between high and low water is 22 feet.

The Nile, then, affords a navigable channel for 1000 miles above Omdurman to Lado, but navigation is much impeded by sandbanks and sudd, and there is great scarcity of fuel for steamers. It was blocked with sudd from 1870 to 1874, from 1878 to 1881, and in 1884 and and 1895. The sandbanks are troublesome, because they are continually shifting their position, but they do not appear to be a very serious obstacle. The Nile also contains many islands, of which the Aba, in 13½° N. lat., is noteworthy as at one time the home of the Mahdi.

The Bahr-el-Ghazal is the most important of the tributaries, not because of the volume it contributes, but because of the large area it drains with its numerous tributaries. From Meshra-er-Rek it flows in a long arc, over 140 miles long, to Lake No, which it enters by a narrow channel. Its depth is 30 feet below the mouth of the Bahr-el-Arab, and only 15 feet above. Where it is joined by this affluent it expands to a width of 1000 feet: and above the current is hardly perceptible. The Bahr-el-Arab rises in southern Darfur, and has a course of 400 miles. It is 120 yards broad 300 miles above its mouth, and is said by the natives to be navigable for 30 miles farther, up to Taimo. Little is, however, known about it. Another affluent, the Rohl, enters the Ghazal on the right bank, between the mouth of the Arab and Lake No, but its lower course and the position of its mouth are not accurately known, and the Jau (or Ayel) probably joins the main stream half way between the Rohl and the Bahr-el-Arab.

At Meshra-er-Rek the Jur or Geddi unites with the Tonj to form the Bahr-el-Ghazal, the former being the lower course of the Sueh. The Pango and the Kuru also join the Jur, according to Lupton and other authorities, but are sometimes represented as forming with the few tributaries of the Ghazal still farther west a separate river, the Bahr-el-Homr, flowing to the Bahr-el-Ghazal between the Jur and Bahr-el-Arab. These rivers are formed by the union of many small streams, but after entering the lowlands they receive hardly any affluents. In the dry season they are fordable, except the Jur, which Junker found to be 10 feet deep and 230 yards broad, and the Wau. But in the rainy season their depth becomes comparatively great, and they flood a large expanse of country on either side. Captain Marchand succeeded in navigating the Yobo and Sueh from Tambura, which is distant less than 50 miles from Mere on the Boku in the Mbomu basin.

As the land rises towards the south, the soil changes from alluvial clay covered with treeless grass steppe to laterite interspersed with granite blocks, and trees become more common. Dense forest entangled with creepers skirts the rivers and brooks, and groups of trees are sometimes found on the intervening lands. Probably they would be more numerous were it not for the fires which the natives light to burn the withered grass in the dry season.

The sluggish current of the Bahr-el-Jebel, Bahr-ez-Zeraf, Bahr-el-Ghazal and the lower courses of its affluents, the marshes and numerous creeks, favour the formation of the sudd which has been so

often mentioned. In the lagoons and backwaters aquatic plants grow with great luxuriance, which are detached from the soil during floods and carried into the rivers, where the sluggishness of the current allows them to collect into dense masses. So compact are these floating islands that the Nuers sometimes take up their abode upon them, supporting themselves by fishing, and hippopotamus and crocodile getting entangled among them die of starvation. A protracted block of the Nile is of rare occurrence as the river is always flowing below. In the lower reaches of the White Nile the current is strong enough to tear away portions of the mass, which are carried down rapidly past Khartum, beyond which they become stranded or become waterlogged and sink to the bottom.

The country east of the Bahr-ez-Zeraf and Bahr-el-Jebel, towards the Sobat, is almost unknown, except for a comparatively short distance in the south, where are the Irenga and other mountains already briefly described.

Like the Bahr-ez-Zeraf, the Sobat, which enters the Nile 505 miles south of Khartum, flows during the last 60 miles through flat and marshy country with a little timber and abundance of tall grass. At high water it is 26 feet deep, and has a powerful current. As Nasser is approached the woods become more extensive. A little above this station the river is formed by the Baro and Juba, the former flowing from the highlands of Kaffa, and receiving several tributaries from the south, and the latter running from the south-east, and rising near the sources of the stream which enters the north-west corner of Lake Rudolf. The country around both these rivers is very marshy for some distance above their junction, and, being therefore pestilential, is uninhabited.

The Blue Nile or Bahr-el-Azrek flows through Lake Tana in Abyssinia, 5800 feet (1800 m.) above sea-level, with an area of 1160 sq. miles, and has a course of 846 miles. It is navigated by nuggers, usually as far as Karkoj, in the dry season, when there is sufficient water, as during high-water the boats cannot contend against the current and the frequent strong south winds; but steamers can ascend to Fazokl. The country in the upper stretches of the river and along its tributaries, the Rahat and Dinder, is well wooded, but near the mouth it becomes bare, sandy, and uninteresting. A proper system of irrigation would render Dar-Sennar, the country between the Blue and White Niles, exceedingly productive, bringing into cultivation an area of more than 9000 square miles of excellent alluvial soil. Hitherto only the lands along the streams which are flooded in the rainy season have been brought under cultivation.

North of the Blue Nile to the Atbara extends the island of Meroe, once the seat of a powerful monarchy. It is in general level, and towards the south-west is fertile grazing-ground and pasture land, but becomes dry and stony towards the east and north. To the west, beyond the Atbara, stands Kassala, built in 1840 as the capital of the Taka province. The Khor-el-Gash, on which it stands, floods the plain during July and August, leaving a deposit of fertile alluvium, and water can always be obtained in the dry season by digging. The town, 1700 feet above sea-level, is dominated by a huge granite mass rising to a height of 3300 feet (1000 m.). To the north the Khor Baraka, lined with vegetation, especially tamarisk, forms a green strip between sandy and stony country and mountains of

bare granite and schist, which sometimes rise to 6000 feet above sea-level. Along it and its tributaries, the khors Langheb and Logueb, routes well supplied with wells run to the fertile plain of Tokar and to Suakin.

Between the Khor-el-Gash and the Atbara stretches a vast savannah with patches of mimosa, which is scorched up in the dry season. Passing Goz Rejeb, a flourishing town before the Mahdi outbreak, the Atbara receives the Gash at Adamara, and enters the Nile at Ed Damer, above Berber. Though the river has a length of 550 miles, it has the character of a mountain torrent; dry in the spring, except a few pools left where the vegetation on the banks protects the water from evaporation, its bed, 16 to 20 feet deep and 500 yards broad near the mouth, is suddenly filled as soon as rain falls in Abyssinia, and the adjoining country is inundated to a distance of two miles.

Then the inhabitants retire into the desert, returning to plant their crops, when the water falls, in the rich mud it leaves behind, and which it brings down in larger quantities than any other Nile tributary. From Ed Damer to its mouth, a distance of 1100 miles, the Nile receives no tributary.

Between Khartum and the Atbara, at Shabluka, is situated the sixth cataract, a series of rapids of ten or eleven miles long, which are easily navigated at high water, but with increasing difficulty as the Nile falls.

The rest of Nubia down to Aswân contains an area of perhaps 96,000 square miles, of which barely 1500, almost all beside the Nile, are cultivable. Near the Red Sea extend mountain ranges composed of archæan rocks and rising gradually from south to north until they attain a maximum, in Jebel Elba, of 6900 feet, while between Berber and Suakin the average height is 3000 to 4000 feet, a few peaks attaining to 5000. From these coastal ranges others run westwards or south-westwards, some of which are continuous, while others are interrupted by extensive breaches. The highest of these transverse chains are composed of crystalline rocks, but there are some isolated elevations of not more than 1600 to 2000 feet which are composed of sandstone. On the western side of the Nile, also, ranges of primitive rocks accompany its course, the most elevated, Jebel Magaga, Jebel Gakdul, and Jebel Gilif occupying the centre of the great bend between the sixth cataract and El Dabbeh. These attain a height of 3300 to 3600 feet. Small tracks of pasture land occur in many parts of the country, but the cultivated land lies in strips now on one side of the Nile, now on the other, the most extensive belt lying above Ambukol, where it occupies both banks of the river. Dongola is of importance as the point of convergence of trade-routes from Khartum, Kordofan, and Darfur.

The Climate.

The limit of tropical rains, which runs across the White and Blue Niles a little above Khartum and extends north-eastward to the upper Gash, divides the country into two sections differing widely in climate and consequently in their fauna and flora. To the north rain falls in a few heavy drops with thunder, and often fails altogether. The rains do not

become regular till New Dongola is reached. The mean temperature at Wadi Halfa is 71° F. for January and 93° for July, the mean daily range is 28½°, and the mean relative humidity is 32 per cent. In Gallabat, Gedaref, and Sennar, which lie just within the limit of tropical rains, the rainy season, the Kharif, begins at the end of June and lasts till the end of December. Storms come from the east and south-east and dry weather accompanies the constant north winds which set in at the end of October. At Khartum the Kharif assumes the form of thunderstorms from the east and south-east between July and September, with a few showers occasionally in May. In April the temperature reaches a maximum of 116°; the mean for the year is 84°, and the mean daily range is about 27°. The humidity is about 46 per cent. in spring and 60 per cent. in the rainy season. In Kordofan the regular rainy season sets in in July with south and south-west winds, and after that it usually rains every third or fourth day until the end of September, when the wind changes to the north, and by the end of January most of the wells are dry. Though the climate is not very hot, the elevation being considerable, intermittent fevers are very prevalent.

On the Upper Nile, between 6° and 9½° N. lat., the mean temperature is about 83½°, and the first rains fall in the early part of March. At the equinox southerly winds succeed to the northerly winds prevailing in the winter half of the year. The rainfall amounts to 124 inches. At Lado the rainy season lasts from April to September, and December to February are the driest months. South winds are frequent at all seasons, and the annual movement of the temperature accords with that of the southern hemisphere. The annual mean is 80°, the absolute maximum 108°, and the absolute minimum 62°. The lower parts with the numerous water channels are naturally unhealthy, but along the elevated watershed there are many districts which enjoy a healthy climate for such latitudes. Emin Pasha considered Makraka and the Shuli country suited even for European colonisation.

Flora and Fauna.

Emin Pasha has included the valley of the Bahr-el-Jebel in the domain of steppes—wooded steppes clothed with beautiful forms such as *Khaya*, *Bassia*, *Balanites*, acacia, *Zizyphus*, gardenia, and many others. Eastward of the river the vegetation approaches more and more to that of the sandy plateau of the Somali country, and following the configuration of the country the limits of certain forms lie much farther to the south. For instance, the dum-palm (*Hyphaene thebaica*) forms woods in Latuka, while its usual southern limit is 5° 30′ N. lat. On the west of the river in the basin of the Bahr-el-Ghazal the steppe often intrudes in wedge-shaped strips into the more elevated forest region. Even here the woods are open and straggling, in nowise resembling the dense, almost impenetrable, forests of more southern latitudes. The same forms appear at higher latitudes to the west, the oil-palm appearing in the west of the Bahr-el-Ghazal, whereas in the Equatorial Province its northern limit is 3° 40′ N. *Calamus secundiflorus* and *Pandanus* also

grow in Makraka, while more to the east they do not cross 2° 20′ N. lat. The deleb-palm has its northern limit at the mouth of the Blue Nile and grows well at Dufile, beyond which it becomes rarer towards the Equator. Palms are not very numerous in the Sudan.

Among plants useful to man may be enumerated the butter-tree (*Bassia* or *Butyrospermum*), the papaw, bananas, tamarinds, baobabs, figs, dates, indiarubber and ebony, and the cultivated plants, such as durra (*Holcus corghum*), eleusine, dokhn (*Penicillaria*), sesame, sweet potatoes, yams, tomatoes, tobacco. Cotton and sugar are grown near Kassala, and wheat also along the Nile below Khartum and in Darfur; Kassala also produces coffee, and cotton is also found in small quantities in Kordofan, Darfur, and the Bahr-el-Ghazal.

The low country along the Bahr-el-Jeleb and the Bahr-el-Ghazal produces chiefly grass and reeds, papyrus and other water plants. The ambatch (*Herminiera elaphroxylon*) found on the lower courses of all the tributaries of the Nile is a remarkably light wood from which the natives make rafts capable of supporting three men and yet easily carried by one. The desert country has the usual desert vegetation—acacias, mimosa, baobabs in some parts, and sycamore, cactus, and euphorbiaceæ.

The fauna shows in its distribution the same peculiarities as the flora, and on the east of the Upper Nile are found zebras, antelopes, giraffes, hares, the Cape ant-eater (*Orycteropus*) and *Manis*, and in the woods monkeys (*Theropithecus* and *Cercopithecus*); and the birds also, among which is the ostrich, are denizens of the steppe. East of the Bahr-el-Jebel the same mammals are found with the exception of the zebras. Of birds there are many West African types, and many of our common British birds, as the nightingale, redstart, and reed-warblers, migrate thither in the winter. Several forms are found in the Egyptian Sudan which now have their proper homes in very remote parts, such as the ant-eater already mentioned and a lemur, a family almost confined to Madagascar and the adjoining coasts of Africa. The giraffe and the ostrich are also found farther north on the Sobat, Blue Nile, etc., wherever the steppe and forest lands meet, while gazelles frequent the bare deserts often at a considerable distance from any supply of water.

Hippopotami and crocodiles are exceedingly common, and wading birds, the most singular of which is the *Balaeniceps rex*, so named from its enormous beak. The elephants have been considerably reduced in numbers by the keen demand for ivory, but large herds are still to be found. Lions, leopards, cheetahs and hyænas are abundant in many parts of the country, and buffaloes and wild boars are hunted. Cattle, zebus, sheep, and goats are kept as domestic animals, and dogs are used by some tribes for hunting.

In general it may be said that the Upper Nile valley is the meeting place of the West and East African faunas and floras.

The Tribes of the Sudan.

The population of the Sudan may be divided into two main divisions, the Mohammedans of the northern portion, Nubia, extending southwards

to Khartum, Dar Nuba, and Darfur, and the pagan and more or less pure Negro tribes of the upper Bahr-el-Jebel, Sobat, and Bahr-el-Ghazal. But though in the north the Mohammedan religion is predominant, and the Arab customs and language are widely diffused, there are considerable racial variations. Originally inhabited by Nubians, that is, Negroes, the country was in very early times invaded by Hamites from Egypt, who founded the kingdom of Meroe, about 900 B.C., and many centuries before had established colonies at Dongola and other places farther north. The mixture of races was rendered still more complex by the incursions of the Arabs, which commenced in the seventh century A.D., soon after the conquest of Egypt. Consequently there is such inextricable confusion of racial characteristics, language, and customs, that several tribes cannot be classified with certainty.

To the Nuba race belong most of the agricultural inhabitants of Kordofan, the Furs, and the settled population of Sennar. The tribes of purest blood occupy Jebel Daier, and one or two other mountain groups of Kordofan and Dar-Nuba, where they have maintained their independence, and still hold themselves aloof from their neighbours. As a rule the Nubas of these districts profess Mohammedanism, but retain the superstitions of their Negro ancestors. To the same race belong, as indicated by similarity of language, a number of tribes in the Nile valley, who are known collectively as Barabra, from the town of Berber, once the capital of a powerful Moslem Nubian State. Most noted among them are the Danagla, or Nubians of Dongola, who have a considerable admixture of Arab and Turkish blood. The Nubians are in general a peaceful industrious people, living exclusively on agriculture, though the Mahdi was a native of Dongola. Morally they are very degraded, ignorant, treacherous, avaricious, and brutal.

The Hamitic tribes are known as Bijas, most of them speaking the To-Bedawiet language. These include the Ababdeh, the Bisharin, Hadendoas, Amarrars, and perhaps the Kabbabish. The first mentioned dwell north of the Sudan proper, on the east of the Nile. The Bisharin occupy the country from Abu Hamed to the vicinity of Jebel Elba, and are nomads and trade carriers, and celebrated for their breed of camels, while the Hadendoas adjoin them on the south, between Suakin and the Atbara. On the other side of the Baraka dwell the Beni-Amer, who are nomad herdsmen. The Bijas are a handsome race, with regular features, crisp hair, which they dress fantastically with great care, and light-brown complexion. Many of the tribes have submitted to Arab chiefs, speak Arabic, and often claim an Arabic descent; while, on the other hand, a few Semitic groups have adopted the Hamitic language from the Hadendoas. The Kabbabish, one of the largest tribes in the Sudan, occupying a vast extent of country from the province of Dongola to Darfur, are of doubtful origin. Though they speak a pure Arabic, they are not of Arab race, but possibly of mixed Berber blood. They own large herds of camels, cattle, and sheep, and used to hold the monopoly of the transport industry north of Kordofan.

The Arab tribes speak a pure archaic Arabic, and many are still of pure blood, and retain the customs of the race. The Gararish, on the

right bank of the Nile, from Wadi Halfa to Merawi, have evidently an admixture of Bija blood; they are partly nomadic, partly agriculturists, as are also the Shagiah, who dwell along the Nile from Korti to Birti, and in part of the Bayuda desert. The Hauwawir, who roam from Dabbeh to Khartum, are pure nomads with large flocks and herds and a large number of camels. The Jaalin of the north of the island of Meroe have upright foreheads, sharp noses and pointed chins, whereas the Shagiah have sloping foreheads, rather aquiline noses, and slightly retreating chins. The Jaalin are unscrupulous in their dealings, and cruel slave-traders. The Baggara tribes of Kordofan have extended their domain into Sennar on the east and across the Bahr-el-Arab on the south-west. They are remarkable for their fine physique and handsome features, and are great hunters and warriors, having constituted the real fighting force of the Mahdi. They use oxen for saddle and pack animals, and their arms are the lance and the sword. The Shukriyeh, north of the Blue Nile, is a large tribe, whose history is unknown; their name is Arabic, but they did not join the Mahdi, and have held no communication with the western Arabs. There are also several other small tribes of pure or mixed Arab race, varying to a slight degree in customs and habits.

The Upper Bahr-el-Abiad, Bahr-el-Jebel, and Bahr-el-Ghazal are homes of totally uncivilised Negroes. The Shilluk, on the western bank of the Bahr-el-Abiad, below the mouth of the Bahr-el-Ghazal, for a distance of about 250 miles, as well as the lower course of the Sobat, with whom the Niuak farther up the river are probably connected, the Jurs on the affluent of the Bahr-el-Ghazal of that name, the Shuli north-east of the Albert Nyanza, and the Luri on the north-west, though so widely separated, exhibit a striking similarity in language, customs, and habits. The Shilluk are constantly increasing in numbers, and probably in former times, finding no room for expansion, surrounded as they are by other tribes, sent out bands of emigrants to the south and west. To the Jurs also belong the Bellanda on the Sueh.

The Shilluks, like the other Negro tribes in the neighbourhood, wear no clothing (the women wear an apron of calf-skin); they do not tattoo themselves, but bedaub themselves with ashes, and knock out the lower incisors. They also devote great attention to the dressing of their hair, and the peculiarly national arrangement is a broad coxcomb, stretching over the head from one ear to the other. Their huts, of the common circular form, are distinguished from those of their neighbours by their higher mud walls and dome-shaped roofs. Their occupations are cattle-grazing, agriculture, and hunting. The cattle are of the zebu breed, the sheep have a mane-like growth of hair on the shoulders and breast, while the goats are similar to those of the Bedawin tribes. The Jurs have abandoned the chief occupation of their race, cattle-grazing, and have become agriculturists and workers in iron, fishing also in the summer, while the Shuli and Luri have met with new natural conditions in their adopted homes, but their customs are in many important details similar to those of the Shilluks. Their huts are similar, they remove the lower incisors, are averse to the use of clothing, fond of ornaments and

hair-dressing, set apart trees for votive offerings, etc. They are a sturdy race, capable of holding their ground against intruders.

The Dinkas occupy the lowlands of the Nile valley south of the Bahr-el-Ghazal on both sides of the Bahr-el-Jebel, their territory extending over more than 40,000 square miles. They have no political union, and the various small clans are often at feud with one another. In stature they are rather above the middle height, are long-limbed, and have small heads, strongly prognathous; their colour is a very dark brown. They are fond of combing their hair straight up, and colouring it red. Their dwellings are not collected into large villages, as among the Shilluks, but are scattered about among the tilled fields; the cattle are all collected together in large enclosures, whereas each Shilluk has his own paddock. Peculiar are the small ante-rooms in front of the entrance to the huts.

A third race is the Bari, which adjoin the Dinkas on the south, from about 30° to 32½° E. long. Their territory is small, with an area of only some 15,000 square miles. Divided into some seven or eight tribes, they retain, as with the other races, certain common customs, as the removal of the lower incisors and a fondness for colouring themselves with red ochre. A peculiar custom is the compression of the skull at the temples, whereby the upper part is thrust upwards, a deformation rendered more conspicuous by the practice of shaving the head. Besides bangles and rings of iron and ivory, necklaces of teeth and shell, tattooing is used as a form of ornament. The Bari are great smokers, using a smaller and more elegant pipe than the Shilluks. The villages are seldom of large size, but consist of a few huts, each surrounded by a fence of euphorbium, standing more or less closely together. The roofs of the huts are conical, and the entrance is so low that a man must crawl through it. The Bari are an impudent, lazy, treacherous, and cowardly people, and do not readily submit to a systematic administration.

The above tribes all dwell in the flat alluvial grass-lands of the Nile basin, except in so far as certain sections may have migrated into the higher lands, and are therefore known as Negroes of the swamps. The remaining tribes of the Sudan are the iron-workers who extract the metal from the ferruginous clay which covers the slopes of the watershed. These also fall into three great divisions: the Bongo, the Mittu, and the Madi, with the Moru and Kederu. They are sparsely distributed over an area of 12,000 square miles, the density not much exceeding eight persons to the square mile. The Bongo, in the west of the Bahr-el-Ghazal, appear to be a tribe that is fast degenerating. They have no social organisation, no history or tradition, and no aristocracy, the only authority being that of the most prosperous man in each small community, sometimes enforced by a reputation for witchcraft, and therefore they were not in a position to make any resistance to the armed bands of the slave-traders. Like the Madi and Mittu they are of middle stature, the height of the men averaging 5 feet 7 inches. Their build is more compact than that of the swamp Negroes, their muscles more developed, the body longer, and the skull broader. The women are

much inclined to stoutness. The skin is reddish brown, the hair black, short, and crisp, and the beard scanty. Various disfigurations are in vogue, of which the most remarkable is the enlargement of the upper lip by means of a wooden peg. Among this people it is the men who clothe themselves most, with skins and pieces of cloth, while the women wear little. They all exhibit considerable skill in working in iron, wood, and clay, and a certain degree of artistic talent which, under judicious guidance and with better implements, might make them efficient workmen. The Mittu, neighbours of the Bongo on the east, are in their customs, dress, and practices much more nearly allied to the Bongo than to the swamp Negroes, and their language shows some relationship to that of the former race. They are, however, of weaker physique.

About 19,000 square miles of territory are occupied by the Madi group. In the upper valleys of the Rohl and Gel live the Moru and Kederu, while to the south, round the north end of Albert Nyanza, separated from the above by the lands of the Bari and Makraka, dwell the Madi proper. The former group suffered much from the raids of the Nubians, and their cattle were driven off, so that they have abandoned grazing and devoted themselves to agriculture. The southern group was less exposed to these attacks, and in the western parts of the country there are still large herds of cattle. The Madi are, however, industrious agriculturists. They are a fine race, about the middle height, of a light-brown colour, with round heads and slightly projecting lower jaw. Their neatly built huts are grouped together in villages; they are hemispherical, and the wall, when there is one, is formed of reeds covered smoothly over with mud. Sometimes the roof projects and is supported by a colonnade. Iron bangles and necklaces are worn in large numbers, brass and copper rings, strings of iron beads round the waist, and the hair is elaborately dressed. Paint is also freely used. Antelope and goats' skins are used for clothing, but in the Nile plain the men wear nothing, following the custom of the swamp Negroes. Polygamy is very general. The various tribes of this group have developed considerable differences in dialect, while retaining uniformity in customs, ornaments, dress, etc.

Besides the groups and tribes enumerated above, there are many small communities exhibiting considerable divergences in dialect, habits of life and occupations, and some that seem to belong to distinct subdivisions of the Negro race. The Makraka are immigrants from the Welle basin, and the Latuka exhibit a marked individuality. This small tribe dwells principally in the broad valley of the Khor Kohs, surrounded by the Shuli. The men are tall (5 feet 9 inches), of graceful build, strong and well proportioned, and with good features, while the women are also tall (5 feet 7 inches), but heavy, awkward, and plain.

The total population of the Egyptian Sudan before the Mahdi insurrection was about 10,000,000, of whom about seven millions were Negroes of the upper provinces.

The natural resources of the Egyptian Sudan are capable, under a strong and stable government, of maintaining a large trade. Ivory may

still be obtained, and grain, skins, coffee, tobacco, ostrich feathers, oil, indigo, rice, cotton will be produced in ever increasing quantities as security spreads. All the above articles, and many others, are products of the Bahr-el-Ghazal and Bahr-el-Jebel districts; Kordofan and Darfur export raw hides and cattle and gum, besides ivory and ostrich feathers obtained from the south, and Damur cloth comes from the latter country. In the upper districts inhabited by Negroes much larger crops will no doubt be raised, and the natural products, such as indiarubber, more industriously collected when the people find that they may be profitably exchanged for European articles; and in the drier countries of the north corn may be grown in much larger quantities, with the help of irrigation. The railway to Khartum will improve the communication hitherto impeded by the cataracts, and probably at no very distant date the trade of the Equatorial province will also find an outlet to Uganda and to the east coast by the railway now under construction.

A TRIP TO NORTHERN ANGONILAND.

By H. Crawford Angus.

Though public attention has lately been drawn to Northern Angoniland (commonly known as Mpezeni's) by an account in the papers of the uprising of the inhabitants of that country, comparatively little is known of Mpezeni's country and its people. This being the case, I have ventured in the following paper to give the result of a few of my observations, made during a trip to, and a short residence in, that country.

Northern Angoniland, as can be seen by a reference to a map of Africa, is situated about 150 miles west of Lake Nyassa and 250 miles north of the Zambesi river. It is a comparatively small strip of country, the total area being certainly not more than twenty miles square; yet it is inhabited by one of the fiercest and most powerful of the African tribes.

The Northern Angoni, as they are now called, are an offshoot of the Zulu race, a party of whom, many years ago, deserted from Chaka, the king of Zululand, and under the leadership of Kazungandawa, one of Chaka's bravest warriors, steadily fought their way north, conquering as they went, till at last, rich in women and cattle, they crossed the Zambesi river. They seem to have stayed for several years in the country lying to the west of the Loangwa river, making this their headquarters from which to despatch raiding-parties to harass the neighbouring tribes; but, moved by their wandering spirit, they at last crossed the Loangwa and settled in their present position.

Kazungandawa and most of the members of the party that crossed the Zambesi are now dead. Mpezeni, Kazungandawa's son, reigns in his father's stead. The pure Zulu blood has become mixed, and the race has degenerated from its original stock by constant intermarryings with the

women of conquered tribes; but enough of the old Zulu blood remains in the present generation to make them the terror of the inhabitants of Central Africa, whose countries they have devastated by their predatory warfare.

It was in the end of the year 1896 that I first came into contact with the Northern Angoni. I was then in the employment of a gold company that was exploiting Northern Angoniland and trying to develop its resources.

There are several recognised routes into Northern Angoniland:—One from the west, *i.e.* from Kota-Kota on Lake Nyassa, and three from the south; one joining the Zambesi at Tete; another at Chakoa some way above Tete; and another at the Karoabassa rapids. The second of these routes is the shortest from Tete, the headquarters of my company; but the distance between the various streams is great, and thus this route is impracticable for heavily laden porters; and the first route was the one I chose by which to make my first journey to Northern Angoniland.

My journey was, on the whole, uninteresting, and I had great difficulty in keeping my caravan, consisting of about 100 porters, together. Our route at first led through a flat, sandy country, densely covered with thorny bushes affording little shade; and it was not till the third day that we reached Mchena, the capital of Makanga. Mchena is situated on the Revubwe river, the distance from Tete to Mchena being about fifty miles. This town is the headquarters of Chinsinga, the chief of Makanga, and is strongly enclosed by a high stockade, formed of upright poles placed firmly in the ground and bound together and strengthened with bark and bamboos.

On entering the stockade, the visitor finds himself in a small courtyard or bastion, where Chinsinga's guard, numbering fifty men, armed with Martini-Henrys, are stationed. After waiting here till the chief is apprised of his arrival, the visitor is ushered into the village itself. This is composed entirely of the huts of Chinsinga's wives and female relations, any man daring to enter these sacred precincts without being sent for running the risk of severe punishment and even death. A few boys acting as pages are seen here, but even they sleep in the outer courtyard.

Chinsinga himself is cruel and arrogant by nature, and of a very jealous disposition, and though I was capital friends with him during the two days I stayed in his country, I was aware that it would need but little provocation to make him show the less pleasant side of his character. He is much feared by the natives of the surrounding country, and levies taxes throughout his dominions. He is to a certain extent educated, and can write and read Portuguese, and has also a fair knowledge of arithmetic, having, I believe, been educated by the Jesuit fathers near Tete. Mchena itself seems well cultivated, and the soil appears to be rich and fertile.

After leaving Mchena[1] the way became more arduous, the ground

[1] Some people call it *Muchena*, but I think "Mchena" the right way of spelling it, being the way it is pronounced by the natives. "Muchena" would mean "in Mchena."

being stony and the country hilly, and much cut up by rivers and watercourses, but the only river of any importance that we crossed was the Pomfi, a fine deep stream, a tributary of the Revubwe. The country we traversed was sparsely populated, and sometimes we did not see a village from sunrise to sunset. The timber, I noticed, was fairly large, the "masuko," a fine fruit-bearing tree, being predominant. I also saw a few palms, and on the banks of some of the small watercourses the raphia-palm.

The third day's journey from Mchena we reached the Chiritzi river, a large stream which, converging with the Loangwa, Luia, and Kapochi rivers, flows into the Zambesi at the Karoabassa rapids. We rested on the banks of the Chiritzi for a day to obtain fresh carriers, as many of those enlisted at Mchena had deserted, complaining of the weight of their loads and the bad weather we were enduring. Here the principal chief, I found, was Katuza, who had lately been attacked and beaten by Chinsinga, and had now acknowledged him as his suzerain.

The people inhabiting this country are a mixture of Azimba and Asenga, and live among the hills in the precipitous gorges and the forests that seam their sides and crown their summits. They are a wild, strange-looking race, their only dress being bark cloth, or the skins of goats and animals killed in the chase.

There are several large mountains in the country, but they are all isolated from one another, and do not form what can be designated as a range.

Having obtained the required number of carriers, we again started, and continued our march, passing several large mountains on our way, the country traversed being rugged and hilly, the path winding along the base of the hills and climbing up through the mountain gorges, and again descending on the other side preparatory to scaling another opposing height. The vegetation here we found very dense, most of the hill-sides being clothed by thick brakes of bamboos.

This day we crossed the Loangwa river, which, as I mentioned before, is a tributary of the Zambesi, and converges with the Luia, Chiritzi, and Kapochi, and of these the Loangwa may fairly be considered, in my opinion, the largest and most important. The Loangwa river forms the natural boundary to Makanga, the country between it and Northern Angoniland being inhabited by a tribe akin to Katuza's people, but who are governed by a stronger chief. This chief, Likungwi, and his people have for many years waged constant war with the Northern Angoni and Chinsinga, the chief of Makanga, whose favourite raiding ground is Likungwi's country.

Likungwi's head village is strategically situated on the summit of a precipitous hill, which overlooks the plain traversed by the Loangwa river, and from here I obtained a splendid view of the surrounding country. Towards the south and east nothing but continuous ranges of low, wooded hills, and here and there a solitary peak, met our gaze, but on turning to the north and west the eye wandered over an immense plain, bounded in the dim distance by the blue peaks and precipitous range of Asenga and Northern Angoniland. Through this plain, covered

with unbroken forest, the river Luia wends its way, its course clearly defined by the dark green foliage of the trees that clothe its banks, while here and there a smaller strip of green, crooked and snakelike, indicates some small tributary that adds its water to swell the tide of the greater river. It was like a peep into fairyland, and the blue mountains in the distance, seeming to bar the way to further progress, roused in me that longing for discovery that sooner or later must come to every man in any way acquainted with African life. As a matter of fact, I was soon to be disenchanted, and my poetical ideas roughly dispelled. The next day, on leaving Likungwi's village, we struck an elephant-path, and at first got on splendidly, but this state of things did not last long. The path became rough and stony; the heat became intense, and shade there was none, the only kind of vegetation that seemed to flourish here being spear-grass and thorn-trees. The ground was of a dark red colour, and as hard as a brick, and every now and then an outcrop on the path of sharp-pointed white quartz would make my carriers wince and use language that could not be called parliamentary. Water also was scarce, and of game I did not see a hoof the whole day, though now and again we would cross the three-months'-old spoor of some solitary deer. Birds as well as beasts seemed to have totally abandoned this barren desert; and when at night we reached the Luia river and camped there, my pleasing illusion of the previous day had been completely dispelled by the hardship of the way. I may mention here that all the rivers we crossed on our journey rise towards the east, flowing at first due west before they take a sharp turn south to join their waters with those of the Zambesi. The next day we made an early start, and soon began to enter a more generous land; the thorn-trees became scarcer, and fairly large thickly foliaged timber took their place. We also crossed fresh game-tracks, and streams became more frequent. We had now begun a steady ascent from the Luia valley, and continued to ascend the whole day by a fairly good track, till at night we reached a large swamp, in the vicinity of which, other water failing, we had to camp. The next morning we made an early start, and determined to reach the Company's headquarters, forty miles distant, that night. This day we still continued to ascend, the country gradually becoming more broken and hilly, and numerous ravines and plentiful streams had continually to be crossed.

It was nearly five o'clock P.M. before I reached the first Angoni village, and having long outdistanced my carriers I and my gunbearers were alone together. This village, the chief of which is Mlomo, presents an extraordinary appearance to any one who has only seen the villages of the Yaos and river tribes; instead of a few scattered huts forming the village, as is the custom on the river, the eye here is met by hundreds of conical-shaped huts, closely packed together, and covering a considerable area, and the surrounding country being denuded of trees, these towns form conspicuous features in the landscape.

Our approach was soon observed from the village, and troops of men and women came out to have a look at us, as, following the path, we climbed to the summit of the rising ground on which the village is placed.

Imposing as the distant view had been of Mlomo's village, it had in no way prepared us for the sight that now greeted us. Before us lay an undulating valley some miles in breadth, which, as the heavily timbered hills on either side proclaimed, had once been covered with forest, but was now denuded of every vestige of a tree. Village after village surrounded by waving cornfields, and green plains dotted with herds of cattle, stretched away into the distance. Never before in any of my African wanderings had I seen such an extent of land under cultivation; the cornfields seemed unending, and the size and number of the villages fairly astonished me; and it was not till then that I realised what a powerful and prosperous people were those whose acquaintance I was about to make.

Our march now was an easy one, the paths being broad and well trodden: and with no grass or brushwood to impede our footsteps, we quickly covered the few remaining miles between us and our destination. Our appearance caused no little excitement among the inhabitants of the country, at every village fresh crowds coming out to witness our arrival. The men, I found, were bold and forward, and did not exhibit that cringing manner, or that deference to Europeans, generally noticed amongst a conquered tribe, or a people accustomed to contact with a superior race. Bounding forward with shield and spears held in the left hand, and the right grasping the formidable knob-kerrie, they constantly accosted me, asking me where I was going and the reason of my visit to the king's country, and I had quite a small retinue of these wild warriors when I hove in sight of the Company's station.

This station is formed of a few compactly built houses, surrounded by a reed fence some five feet in height, which, though serving well enough to mark the limitations of the station, would form but a slight defence in time of danger. About two hundred yards from the station is situated Loangweni, one of the largest towns in the country and the head-quarters of the king's chief wife, Lupoko. Though it is difficult to even approximately calculate the number of huts in a native village, owing to their being so closely built one to another, I should estimate Loangweni as containing certainly not under one thousand huts.

It would be difficult, without a map, to accurately show the geographical features of the country, so I shall only note the natural boundaries and some of the distinctive features.

Angoniland proper is bounded on the east by the Bua river, which mingles its waters with those of the lake at Kota-Kota. The Bua river rises on the western slopes of the Mchinji mountains—a long and important range which forms the Lake Nyassa watershed—and runs for some distance parallel with the mountains before passing through a wide gorge to traverse the broad flat plain that separates Angoniland from the lake. The northern boundary of Angoniland is formed by the Sandili river, which also rises on the western slopes of the Mchinji range, but unlike the Bua flows into the Loangwa river, forming in its course the natural boundary between the territories of Mpezeni and those of Mwasi. The southern boundary is not so well defined; and although the Angoni claim as theirs all the country extending to the

Luia, most of this is uninhabited, and the true boundary, I should say, would be somewhere a little north of the recognised Anglo-Portuguese line of demarcation. The western boundary is roughly defined by a high range of mountains called Mpandi, which extends for a great distance north and south, dividing Angoniland from Asengaland and the country of the tribe that acknowledges Undi as its chief.

Angoniland itself, though in some parts undulating, is for the most part flat, and is traversed by no range of hills of any importance, all the elevations being solitary and dotted over the surface of the country. The remarkable feature of Angoniland is the abundance of water, the whole country being cut up by numerous streams, always containing a plentiful supply of good, clear water. The soil is of a dark red colour, the substratum being formed of gravel and sandstone. The rock formation is mostly granite, though here and there quartz is visible. The alluvial soil and sand in the beds of the streams are very rich in iron, and it is astonishing how much metal can be obtained after washing a panful of dirt.

Angoniland is divided into several large districts, each district being governed by a headman appointed by Mpezeni (the king); and in each of these districts a certain number of the king's wives reside—the favourite ones alone living in the king's kraal. This is situated at the base of a large hill which crowns a small plateau that overlooks the surrounding country; and it is here that, besides the king and his favourite wives, the chief councillors reside.

In appearance Mpezeni is tall and dark, long-limbed and lean-flanked; he is generally clean shaven and is quite bald; his face is long and narrow, and his eyes small and bloodshot. He takes large quantities of snuff, and lives chiefly on a sour, unintoxicating kind of beer, made from unfermented maize. This beer is supplied to him by his wives, who all take turn about to brew it. His dress consists of a red fez, cotton shirt, and a loin-cloth of coloured print, while his legs and arms are encircled by strips of long, white-haired goatskin; his ears are split after the Zulu fashion, and in them are inserted large, round pieces of white wood.

The women of the country, especially those having Zulu blood in their veins, are tall and well-formed, having lithe, shapely figures, and long, well-formed limbs.

It is impossible for me, in the space at my disposal, to enter deeply into the politics of the country. Suffice it to say that my life there was often far from safe; and it was only by a good deal of bounce and a display of apparent fearlessness, that we often averted what otherwise might have proved a serious catastrophe.

THE KHEDIVIC POSSESSIONS IN THE BASIN OF THE UPPER UBANGI.

By S. H. F. Capenny.

Introductory.

It is beyond the scope of this article to discuss the right of the Khedivate to the possession of territory in the basin of the Upper Ubangi. With regard to its legal and political aspects, it will suffice to notice that the validity of the Khedive's title was recognised at the Berlin Conference, 15th November 1884 to 26th February 1885, when the representatives of the several Powers accepted the 4th parallel of north latitude and the 30th meridian of east longitude as the limits of the territory to the north and east which was open to occupation by the Congo Free State; and that the Agreement of 12th May 1894 between Great Britain and the King of the Belgians was accompanied by an assurance from both parties that the claims of Egypt would not be disregarded when she might be in a position to assert them.

When Sir Boutros Ghali Pasha, the Foreign Minister of Egypt, wrote to Lord Cromer, on the 9th of October 1898, he said:—"The Government of His Highness, as your Lordship knows, has never lost sight of the occupation of the provinces of the Soudan . . . from which she only withdrew owing to circumstances of *force majeure*. . . . Knowing that the question of Fashoda is at the present moment the subject of communications between Great Britain and France, the Egyptian Government charges me to beg your Lordship to lend us your good offices with Lord Salisbury in order that the incontestable rights of Egypt may be recognised, and that all the provinces which she occupied up to the the rebellion of Mohamed Ahmed may be restored to her."[1]

In his speech at Manchester, on the 15th of November, Mr. Chamberlain announced that "Fashoda is only a symbol," and that the claim which Great Britain makes on behalf of Egypt is "the full control of all the territories which were formerly in her possession, or which fell under the rule of the Mahdi or his successor, the Khalifa."

In accordance with the principle which here governs British policy, that Egypt is to have her own again, it is the aim of this article to ascertain the former limits of the Khedivic possessions in the basin of the Upper Ubangi, with a short review of their history and discovery, as well as a concise account of them in their present state.

History and Discovery.

A historical notice of the Upper Ubangi region with regard to our geographical knowledge may well commence with the narrative and map of Browne in 1799. During his residence in Darfur, from 1793 to 1796, he heard tell of a Dar Kulla and a Bahr Kulla, flowing from the

[1] *Parliamentary Paper*, C 9055 (Egypt, No. 3), 1898, p. 12.

east to the west, away to the south of Darfur. The *jallāba* or slave dealers of Kobbe in Darfur and of Nimr or Nimro in Wadai were in the habit of trading with it, vending salt for slaves at the rate of twelve and fifteen pounds of salt for a male and a female respectively. From their reports he learned that the natives were of a red or copper colour, with a nasal speech; honest, even punctilious, in their dealings with the *jallāba*; and made use of the ordeal of poison. He heard further that the natives of that part of Africa were cannibals, and that the Arab name for them was Gnum Gnum. These reports were confirmed by natives themselves who were slaves in Darfur. On the banks of the Bahr Kulla the pimento tree was abundant, and the native name for it was *kumba*.[1] Here, then, with the first slight indication of the hydrographic system which is now known as the Ubangi, the Nyam-nyam or A-Zandē nation is found associated with it; the characteristics of the natives represent accurately the A-Zandē of recent times, and the word *kumbo* is the Zandē name for the *Xylopia Ethiopica*.

An itinerary of the *jallāba* from the south of Darfur was communicated by Barth to the *Journal* of the Royal Geographical Society in 1853 from the report of Fellāni or Fellāta, a well-educated man who had long been resident at Fayo in South Darfur, one day south of Ammajūra, and had paid a visit to that remote part of Africa along with a *jallāba* caravan between 1820 and 1830. Starting from Ammajūra, he arrived on the sixth day at Dar Ming, east of Dar Runga; on the tenth day at Shala, one day from el-Hofrah [Hofrat-en-Nahās]; on the seventeenth day at a small river flowing east, the Bahr-el-Adda; on the eighteenth at Dar Banda, a pagan country of great extent, bordered on the north by the Bahr-el-Adda; on the forty-first at Kubanda, a large place extending for about ten or twelve miles along the banks of a river so large that they could with difficulty make out persons standing on the south bank, and not fordable. The river ran straight from east to west, and was bordered principally by very large trees called *kumba*, which bore a fruit similar to the date. The direction was west as far as Dar Ming, very little south, but from Dar Ming directly south. The rate of the caravan was some twenty miles a day.[2]

Up to the middle of the present century Lake Chad and the Sudan occupied the field of view in the work of geographical discovery as promoted by the African Association. In Rennell's North Africa map of 1802, revised from that of 1790 and 1798, the Bahr Kulla of Browne is located to the south-west of Darfur, as belonging probably to the system of Lake Chad or that of the Niger. The hydrographic probabilities of the Bahr Kulla evoked many discussions and doubts. On Petermann's map of 1858 to illustrate Barth's itineraries it is located south of Darfur and south of the 4th parallel of north latitude, running straight east to west. A look at this map might well set the mind wondering whence this large river came and whither it went, and even suscitate the desire in an

[1] Browne's *Travels*, 1799, pp. 308, 310.

[2] "Account of Two Expeditions in Central Africa by the Furanys."—*J.R.G.S.*, 1853, pp. 120-21.

enterprising mind to resolve all doubts by the old method of walking. From the way in which he alludes to Barth's Kubanda, this seems to have been the case with Schweinfurth when he set out for the heart of Africa in 1868 by way of the Upper Nile.

A walk in Africa, to use Grant's way of putting it, had become a pretty feasible enterprise. The Khartum ivory traders had long been busy in the Bahr-el-Ghazal. In 1858 Petherick had penetrated to Mundo on the borders of the Nyam-nyam territory, and had been followed in 1860 by Antinori, and in 1863 by Heuglin, but the first to penetrate into the Nyam-nyam domain was Petherick's old henchman, Abu Gurun. The first European to visit the basin of the Welle was Piaggia, between 1862 and 1865, when he is said to have resided for a year with Kifa, the Zandē prince, in the valley of the Mbruole. On the eve of starting from Khartum, in December 1868, Schweinfurth heard for the first time of the Mombattu (Monbuttu or Mangbattu) from the reports of the agents of the Poncet brothers which Antinori had transmitted to him. On his way to Mombattuland from the Bahr-el-Ghazal, Schweinfurth arrived at the Welle on the 13th of March 1870.

Schweinfurth believed, beyond possibility of doubt, that the Welle belonged to the hydrographic system of the Shari. His home-coming was soon followed by that of Nachtigal from the Shari and Chad. In 1875, at one of the meetings of the Paris Congress, the hydrographic probabilities were discussed between them, but the geographical world remained divided up to 1885. Meanwhile the work of Cameron and Stanley had opened up the system of the Congo, and Stanley believed that the Welle belonged to the Aruwimi. In Hassenstein's map of 1885 the Welle is assigned to the Shari; in that of Friederichsen's, which was adopted as the official map of the Congo State, it was assigned to the Aruwimi.

In Mombattuland, Schweinfurth was followed by Miani, who visited the A-Zandē on the Bomokandi, and died at Munza's in 1872. In December 1877 and January 1878, Junker discovered the head-streams of the Welle; and from May 1880 when he arrived at Ndoruma's from Dem Suleiman, till January 1884—when he arrived at the Makaraka district on his way to Lado—he was occupied in working out the hydrography of the whole Welle basin. Within the same period Casati in 1881 to 1883, and Emin in 1883, visited Mombattuland by way of the Dongu valley.

The Mbomu basin had been beyond the line of Schweinfurth's itinerary. He believed it to be a tributary of the Jur, and that its tributary, the Shinko or Bahr Abu Dinga, was a tributary of the Bahr-el-Arab. Potagos,[1] a Greek, was the first European to penetrate into the lands to the west of the Bahr-el-Ghazal, which he visited by way of El-Obeid and Hofrat-en-Nahas in 1876, but little was derived from his itineraries. He was followed by Bohndorff,[2] who had been up the Nile with Gordon in 1874, and penetrated in 1877 west of the

[1] *Bull. de la Soc. de Géographie*, Paris, 1880, II. pp. 5-51.
[2] Petermann's *Mittheilungen*, 1885. pp. 339-50.

Shinko to the territory of the Sakkara. In May 1880 on his way to Ndoruma's, Junker passed from the basin of the Nile into that of the Boku and the Upper Mbomu; and on his way home from Ali Kobbo's in 1883, he mapped the Mbili, the Warra, the Barango or Woworo, and most of the Mbomu basin between the Shinko basin at Ombanga, the Upper Mbomu basin at Semio's, and the vicinity of Ndoruma's.

In 1882, Lupton [1] had passed from Dem Zubeir into the Upper Shinko and Upper Kotto basins, and had ascertained through his agent, Rafai, that the Bahr Kuta, on which he had several posts, was formed by the junction of the Mbomu and the Welle. This report, along with other reports and hydrographic considerations, led to a probability in Lupton's mind that the Bahr Kuta belonged to the Congo system.

On Friederichsen's map of 1885, while the Welle was assigned to the Aruwimi, the Bahr Kuta, represented as the Mbomu and its tributaries, was assigned to the Congo.

Thus, in 1884-5, the Bahr Kulla and the Kubanda had become the Bahr Kuta, when communication ceased by way of the Nile.

Occupation.

Egypt.—It has been seen that the population of Dar Banda and Zande-land, when first heard of by way of Darfur, were visited by the *jallaba* of Darfur and Wadai, from whom they received articles from Europe. These articles had come either by way of the Nile or from Tripoli, and early in the present century a new caravan highway was opened between Wadai and Benghazi. When, therefore, the Khartum traders arrived in the Bahr-el-Ghazal they were received with goodwill among the Krej, A-Banda, A-Zande, and Mombattu, and met with a keen demand for European commodities. At the time of Schweinfurth's visit the lands to the west and south had been divided into territories and spheres of trade, in many of which garrison posts and trading depôts had been set up and were commanded by agents. By and by several of the chiefs, such as Sassa, Morjan and Semio, became the allies, vassals, and agents of the Khartum traders.

In May 1874, on assuming the command of these provinces and dependencies, Gordon sent Gessi and Anson to Meshra-er-Rek to report on the Bahr-el-Ghazal, but the death of Anson, and his need of Gessi, decided him to leave the Bahr-el-Ghazal districts alone, which were held by Zubeir on behalf of the Khedive, and devote his energy to opening up communication with the Lakes. When Zubeir left his province for Cairo, where he was detained, Suleiman, his son, became his representative at Shakka, and Idris, a Dongolawi, his agent in the Bahr-el-Ghazal. Thus the dependencies of Egypt in the basins of the Mbomu and the Welle were dominated by the Khartum traders and by the Zubeir family and their agents up to 1878-9 when Gessi quelled the rising of Suleiman and his Ja'alin associates.

In his organisation of the province Gessi retained several of the

[1] *Journal of the Royal Geographical Society*, 1883 and 1884.

superintendents and agents, such as Rafai Agha and Ali Kobbo, who had either assisted him or held aloof in his campaign against Suleiman. But the scheme which Gessi had in view was a system of vassal states. From 1870 Ndoruma, the Zande prince, had been defending his territory. As soon as Gessi opened communication with him through Rafai, he became the Khedive's vassal. This was in 1879, and by 1881-2 the whole of Zande-land had become the Khedive's territory from the Mbomu to the Bomokandi.

In 1883-4 the eastern part of the Welle basin had been assigned to Emin. One part of it came within the Makaraka district, with its capital at Wandi, and garrisoned posts had been set up at Kalika, Tambira, Loggo, and Mundu. The other part had been organised into the district of Mombattu-land, with Mbaga for its capital, and garrisoned posts at Gango, Kubbi, Tangazi, Gadda, and Dongu.

The line of communication with the capital of the province at Lado was up the Dongu valley, and in 1883 Emin was designing a new line of communication from Gango to Wadelai.

In considering the districts and dependencies that belonged to Lupton's province, it is necessary to keep in view the important fact in the political history of the Welle basin, that the Zande nation had been pushing east and south since early in the present century. The Makaraka or Iddio, the eastern branch of the A-Zande, came into their present territory about eighty years ago. In 1860-5 the Zande prince Kifa was pushing his way to the south from the Mbruole into territory south of the Welle, and even into the basin of the Ituri. The Zande princes of the Mbomu basin had passed to the south of the Welle in recent times, and occupied territory on the Bomokandi. When, therefore, the Zande princes of the north, such as Semio and Sassa, became the vassals of the Khedive, it was in accordance with a historic movement that they made good use of their command of arms and ammunition, and fought for their own hand in pushing ahead to the south of the Welle, demanding a tribute of ivory and dominating the tribes in the name of the Khedive.

In 1883-4 the Welle, from the territory of Ali Kobbo to Amadi-land and the borders of the Mombattu district, was commanded from the Bahr-el-Ghazal by a line of garrisoned posts. From the Welle to Dar-Fertit in the north-west, the whole of the Mbomu basin was commanded by Lupton's superintendents and agents. The territory commanded by Rafai-Mbomu extended to the Kotto in the west, and included the territory of the Sakkara[1]; the territories of Kordofali and Katambur comprised Dar-Fertit and Dar-Banda, and extended to the Upper Kotto. Rafai Agha had also penetrated into the basin of the Rubi, and set up a trading post.

When Lupton was beset by the Dinka and the Mahdists in 1883-4, Rafai and Semio counselled him to retire to their territories on the Mbomu as a strategical base, and defend his province with their aid.

Congo State.—When Gordon arrived in England from Palestine at

[1] De la Kéthulle s "Deux années de résidence chez le Sultan Rafai."—*Bulletin de la Société belge de Géographie*, 1895, pp. 408, 535.

the end of 1883, it was to assume the command of the Upper Congo, in accordance with a promise to the King of the Belgians. On his way to Khartum, in January 1884, he met Bohndorff, who was on his way home from the Bahr-el-Ghazal. From him, and probably from the last reports of Lupton, Gordon learned that the Zande vassals were keeping faith with the Khedive, and he spoke of retiring possibly to the Congo by way of the Nile. He had looked to the Aruwimi as a way of access to these lands, in order to civilise them from the Congo.

On the 23rd of February 1885 the Congo Association became the Congo State. In the preceding November Grenfell had chanced to discover the Ubangi, and ascended it, some time later, up to the Zongo Gut, where navigation was arrested by the formidable rapids. Van Gèle succeeded in passing them in November and December 1887, and he ascended the Ubangi up to the territory of the Yakoma. In 1889, the Congo State decided on the occupation of the Upper Ubangi. In June 1889, Van Gèle founded the post of Zongo at the foot of the rapids; in July, that of Mokoangai at the head of them; in August, that of Banziville, at another rapid; and in October 1890, that of Yakoma. He navigated the Mbomu up to the falls at Wangu, and the Welle up to the falls at Mokwangu. In the same year, Bangasso, the Sultan of the Sakkara, accepted the sovereignty of the Congo State over his territory. Meanwhile, Roget had ascended the Rubi up to Ibembo, where navigation ceases, and had arrived at the Welle in February 1890, at Jabbir, where he founded a post. In January 1891, Van Gèle opened up communication with Jabbir by way of the Welle.[1]

When the veil was lifted[2] it was found that the Mahdists, in 1885, had passed into Dar Fertit and Dar Banda up to the Mbomu, but not beyond it, and into the basin of the Welle. Rafai had retired for a time to the south of the Mbomu, and, on the Mahdists vacating his territory, had resumed possession. Jabbir, who is a son of the Zande prince, Duaro, and had been a dragoman of Ali Kobbo, had succeeded in dominating the district from the Welle to the Mbomu. There had been strife, however, civil and tribal, among the A-Zande. The former vassals and allies of the Khedive had been having a hard time of it, as many of their own vassals and neighbours had united against them. Semio, his men armed with guns, had been holding his own, but the outlook depended on his ammunition. On the Bomokandi the Arabs had arrived about 1890, by way of the Nepoko, and had posts on the Makongo as well as allies among the Zande princes of the Bomokandi district with a view to attacking the A-Zande north of the Welle. It was good news, therefore, to the Zande princes when they heard that Whites had arrived at Jabbir.

Between 1891 and 1894 the agents of the Congo State pushed ahead in all directions into the former territories of the Khedive. In 1892, posts had been set up at Rafai, Sandu, Darbaki, and Dinda among the

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[1] *Bulletin de la Société belge de Géographie*, 1888, 1889, 1893, 1894.

[2] Roget's *Le District de l'Arouwimi et Ouellé*. Gustin's "Vers le Nil."—*Mouvement géographique*, 1898. De la Kéthulle, *op. cit.*

A-Banja or A-Zande of the west; at Sango, Yanguba, Zwarra, and Yangu among the A-Banda; at Bandassi, Alewali, Renogo, Kerengigi, and Mereke among the Krej. Along the valley of the Welle a chain of posts had been formed at Mbima, Bomokandi, Suruangu, Nyangara, Dongu Surure, and Lemin.

In 1893, the agents of the Congo State occupied posts in the basin of the Nile at Katuaka and Liffi in the Bahr-el-Ghazal, and at Kiri, Muggi, Labore, and Dufile on the Bahr-el-Jebel. In 1894, Hanolet had made his way up the Bali and Kotto into the basin of the Shari and Dar Runga.

The occupation of this territory, in the basin of the Upper Ubangi, beyond the limits of the Congo State, was recognised by Great Britain in the Agreement of the 12th of May 1894.

France.—Thereupon France protested. In 1885, the common limit of the Congo State and the French colony was the median line of Stanley Pool and the Congo up to the Likona Nkunja, the eastern watershed of the Likona Nkunja basin and the 17° of E. longitude. As soon as the discovery of the Ubangi became known its importance was recognised by the French, and after long and animated discussions and negotiations, the median line of the Ubangi became the common limit in the Convention of the 29th April 1887. The agents of France soon followed the lead of the Congo State and founded the post of Bangui, on the right bank opposite Zongo, in June 1889; that of Mobaye, opposite Banziville, in August 1891; that of Abira, below the junction of the Mbomu and Welle, in September 1891, on territory which had formerly belonged to the administrative province of the Bahr-el-Ghazal.

In July 1894 the territories of France above Bangui were constituted the Haut-Oubangui province.

In the negotiations of 1894 France held that the Congo State had no right to territory beyond the left bank of the Ubangi and the 4th parallel of N. latitude. In the convention of the 14th August 1894, the territory of the Congo State was recognised up to the median line of the Mbomu and the watershed of the Nile.

The agents of France occupied some of the posts which the agents of the Congo State vacated north of the Mbomu, and have since penetrated into the Bahr-el-Ghazal, by way of the Mbomu and Boku, and to Dem Zubeir, the old capital of the Bahr-el-Ghazal province.

(*To be concluded.*)

THE RILA MOUNTAINS[1]

THE Rila mountains, in the south-western part of Bulgaria, are a massive elevation rising to a considerable height above the surrounding country, and exhibiting numerous patches of snow and marks of ancient glaciers. In 1896 Professor Cvijić made several excursions among them, starting

[1] *Das Rila-Gebirge und seine ehemalige Vergletscherung.* Von Prof. Dr. J. Cvijić in Belgrad. *Zeitschrift der Gesell. für Erdkunde zu Berlin*, No. 4, 1898.

from Samokov on the northern flank, and acquired a very complete knowledge of their structure and glaciation.

Elevations of crystalline rocks predominate in the south-eastern part of the Balkan peninsula, masses of older date involved in the later fold mountains of the Dinaric and Balkan system. The mountains on the east are usually grouped together as the Rhodope system; the western are as yet but little known, and their tectonic connections have not been clearly set forth. The crystalline mountains are distinguished from all the others in the Balkan peninsula by their general form, strike, and elevation. They do not run in long parallel chains, but consist of compact masses with their longer axes lying in different directions, and even the small ridges, sculptured by erosion, differ in direction. As to the sharpness of the ridges and peaks, there is no marked difference between the crystalline mountains and the others; in some cases the former have the more clearly cut forms. This is doubtless a consequence of their great height, for the four loftiest mountain groups of the Balkan peninsula—Olympus, Rila, Šar, and Pirin—are composed of crystalline rocks.

The Rila mountains are the highest of the crystalline mountains of the Rhodope system and, in consideration of their average height, may rank as the highest in the peninsula. They rise to an average of 6100 feet, and cover an area of 445 square miles. The areas within the contours of 6900 and 7900 and of 7900 and 8900 feet are particularly large, amounting to 104 and 52 square miles respectively. Above the latter contour is an area of more than 2½ square miles, and whereas in the rest of the peninsula there are only two peaks which surpass 8900 feet—Olympus and Ljubeten in the Šar-dagh—there are twelve such in the Rila mountains, and thirty of more than 8200 feet in height. The highest peak, Mussala, 9590 feet, is only 165 feet lower than Olympus. The huge massive form of the Rila mountains was peculiarly favourable to the development of continuous glaciation.

Individual parts of the group exhibit sharp ridges and peaks, far surpassing in this respect the Šar-dagh, Durmitor, and the Balkans, and perhaps the other high mountains of the peninsula. Typical *kare* are characteristic of the Rila mountains, and small lakes and patches of firn occur in greater numbers than in the other groups.

All the crystalline mountains of the Rhodope system are connected together, so that the limits of the Rila mountains cannot easily be defined on all sides. On the north they are bounded by the large basins of Samokov and Dupnica, the latter having a length of 8½ miles, with a breadth of 4½, and lying at an elevation of 3050 to 3080 feet. Southwards the Rila descends sharply, often in precipitous walls to the spacious basin of Razlog in Macedonia, drained by the Mesta and its numerous tributaries. Here a broad ridge running out from the Aj-Gedik connects the Rila with the Pirin, forming the watershed between the Mesta and the Struma. To the west the broad valleys of the Struma and Džermen separate the Rila from the lofty Ossogov-Prlavina, while on the east the group blends so thoroughly with the Rhodope that there is no clear division between them.

Running in a direction from north-east to south-west, the valleys of the Leva and Rilska divide the Rila group into two parts. The north-western part consists of crystalline schists, gneiss predominating with thin micaceous layers imbedded in it. Other constituents are mica-schists, amphibolite and crystalline limestone. Later eruptive rocks, though common in the Rhodope group, occur only in two places. Granite is principally confined to the eastern part of the main ridge.

Orographically the north-western division consists of a ridge stretching for more than thirteen miles from east to west, between the valley of the Rilska on the south and those of the Černi-Iskar and Džermen on the north. The whole ridge may be called Pašanica after its eastern half. North of the Černi-Iskar run two much lower ridges, the Dospejski-Bairi and the Ržani-Planina. There is no other ridge in the Rila mountains so distinct as the Pašanica from the saddle Kobilino Branište (between the Rilska and Leva) to the Vrla, where it vanishes into the plateau of Bazar-dere at an elevation of about 7900 feet. The northern slopes of the range bear a number of kare, about eighteen lakes and innumerable patches of firn, while there are no kare on the southern flank, which slopes gently and is covered with grass and stunted brush-wood. On the ridge stand many sharp and lofty peaks which give it the character of a mountainous elevation.

South-east of the valleys of the Rilska and Leva is a loftier part of the Rila with ridges of granite. This is again divided by the valley of the Beli Iskar and the Razlog saddle into two sections, so that the whole Rila group falls into three divisions. Between the Beli Iskar and the Rilska and Leva valleys is a large mass with many branches in which the ridges, not very conspicuous, run from north to south. At the northern end the highest summit, the Draganica, rises in granite cliffs to a height of 8937 feet, and the next highest, the Angelov Vrh in the south, to 8907. In the Mussala ridge the form and the direction, from north to south, are more pronounced. This is the broadest of the ridges of the Rila mountains, and only in a few places and for short distances does it display a sharp-edged form. The height of the ridge lies between 7900 and 8800 feet, and its area is nearly 18 square miles. Several massive summits rise above the general level, so that the area above 8900 feet is remarkably large ($2\frac{1}{4}$ square miles). Typical kare occur only on the eastern slopes, the western flank descending steeply to the valley of the Beli Iskar and serving as a course for immense avalanches.

On account of its height, the Rila is the most important hydrographic centre of the Balkan peninsula, and from it flow some of the largest rivers, besides many smaller streams. The valleys are in terrace form, often in several stages, and therefore the streams pass through rapids and over falls, with stretches of still water between. The upper courses were once occupied by glaciers, and the erosive action of the rivers has not been continued long enough to give the valleys the normal curve. The valleys opening towards the north are very steep, and their rivers have a greater fall than those flowing southwards. The former descend from the watershed to the deep basins of Samokov and Dupnica, 5900 to 6500 feet lower, in a distance of 11 to 19 miles. Moreover, the Rila here falls

immediately into these basins without any flanking elevations, and its very steep slope is undoubtedly connected with the formation of the Samokov and Dupnica areas of subsidence.

All the large rivers of the group flow out of kar lakes, which are fed by water from the snowfields. Only the Iskar belongs to the Black Sea basin; all the others are tributary to the Ægean Sea. The Iskar is formed by the union of four streams, the Černi Iskar, the Leva Reka or Levi Iskar, the Beli Iskar, and the Bistrica. The first, the most voluminous, drains the northern slope of the Pašanica ridge; the second and third have been already mentioned as dividing the Rila group into three sections; the fourth, descending from Mussala, joins the stream formed by the others near to Samokov. On the south-west the Rilska has three headwaters, the Tikha Rila, the Kriva, and the Ilina. The Džermen is a torrential stream, which often floods in spring. The Marica and Bela Mesta rise on the eastern flank of the Mussala ridge.

On the southern edge of the Samokov basin the Iskar issues from a gully in the mountains, bringing down coarse *débris*, chiefly of granite and crystalline schists, on to the basin and converting it into an unproductive plain. This part of the Samokov basin was the chief centre of a primitive iron industry under Turkish rule, and banks of slag show where mining was once carried on. The bed of the Černi Iskar falls in three terraces built up of detritus, the uppermost of which is decidedly older than the other two, and is in all probability of glacial origin. On it stands an expansion of the valley, the only cultivated land along the Černi Iskar, where, at an elevation of 3300 to 3900 feet, are situated the highest settlements of the Rila mountains. Immediately above the terrace, at a height of 4100 feet, is the lower limit of coniferous trees. It is a peculiarity of the northern flank of the Rila that these trees descend so low. Thus, within a vertical zone of about 300 feet, are found the highest dwellings, the upper limit of cultivation and the lower limit of conifers; this is the case in the other compact mountain masses of the peninsula.

The valley of the Leva Reka presents much the same character, but here the traces of glaciation are more unmistakable, consisting of polished surfaces at a height of 5500 feet and above, and striæ all pointing in the direction of the valley. Heaps of huge blocks lower down the valley are probably the remains of terminal moraines. One of the two headwaters of the river emerges from a kar, while the other rises on the saddle Kobilino Branište, at a height of 7080 feet. On the other side of the saddle, the Sukho Jezero (dry lake) stands at an altitude of 6334 feet. It has a length of 630 yards and a breadth of 120; its basin extends two or three hundred yards farther towards the south, but is filled up by the detritus brought down by its only tributary, the Jezerska Reka. The lake has no visible outlet, but its waters filtrate through the rampart of blocks, probably an old moraine, at its south-western extremity, and appear again in springs in the valley of the Tikha Reka. The surface temperature in the lake was $57\frac{1}{2}^{\circ}$ on July 18th, 1896, while in the two chief springs it was $46\frac{1}{2}^{\circ}$ and 44° respectively. At the end of summer the lake is dried up.

The Tikha (quiet) river flows gently in a valley some 300 yards broad between slopes of crystalline rocks 2000 to 2600 feet above the stream. These are clothed with grass and wood, so that heaps of *débris* are seldom formed at their foot. Above the streams that enter the Tikha from the springs, the valley has a different character, being bestrewn with huge blocks of granite under which the fishermen, who come here to catch trout, pass the night, and therefore this part is called the Zimnici (refuges) valley. The river has a rapid fall, descends in rapids and cascades, and is white with foam. The climber passes several moraine walls, and then reaches the headwaters of the Kriva, as this part of the stream is called, which take their rise in three kare.

The kare are the most striking forms in the Rila mountains. They are broad, semicircular hollows with a steep wall at the back and on the other side open to the valley. The bottom is usually flat and contains a number of small depressions filled with water which is shut in by a rocky bar or moraines. Between them are *roches moutonnées* polished and striated. The kare generally occur in groups, separated one from another by sharp edges, and as a rule face the north. Of thirty-two kare in the Rila mountains, twenty-five face north and seven east. They all lie above the forest zone, their bottoms being on an average at a height of 7480 feet, and all being included within a vertical range of 430 feet. This mean height coincides with that of the snow-limit in the glacial period, just as in the Alps, Pyrenees, etc. This fact and the traces of glacier erosion on their bottoms clearly point to the glacial origin of the kare. Firn is frequently a powerful agent in their construction. Snow patches eat their way into the underlying ground, and when they disappear the wind removes the loosened material, excavating shallow basins or dish-shaped hollows, in which the snow collects. Should these snowfields become permanent, a small glacier is developed, which takes upon itself the removal of the loose *débris*. The alternating erosion of the ground by snow, and the removal of the loosened material by glaciers, may excavate in the course of time a depression of considerable dimensions, and thus a kar be formed. Frequent changes of climate are of great importance to their creation, and mountains which do not rise far above the snow-line, and on which the snow covering changes considerably with variation in the height of the snow-line, are especially adapted for the formation of kare.

The finest kar in the Rila-dagh is that out of which the Marica flows, the most voluminous stream in the whole Balkan peninsula. In it may be observed more distinctly than in any other kar the following features. In the background may be seen the bare steep walls of the Mančov-Cal, a summit south of Mussala, with its numerous granite pinnacles. Between there are small channels through which the detritus rolls down. Here and there its course has been checked, and it is piled up in cones 100 feet high. Below this zone lie three lakes, arranged on terraces one above another. Their water is exceedingly clear, so that the deepest parts of the lake bottom are visible. It is covered with large blocks, and descends to 16 to 20 feet below the surface of the water. Two zones may be distinguished—a shallow zone near the bank,

with a yellowish or yellowish-black tint, and a deeper central area where the water is of an emerald colour. Isobaths might be based on the colour and shade of the water.

The upper, smallest, of the Marica lakes lies at a height of 8117 feet, 768 feet below the enclosing wall, being filled in the upper part with heaps of detritus. It is 95 yards long by 20 broad. At the other end a granite sill, surmounted by a wall of loose blocks, dams up its waters. The water finds its way through these fragments to the next lake, 216 feet lower. This is 420 yards long by 55 broad, and is connected by a channel with the last of the series, which has a very irregular outline, and measures 225 yards by 195. Both lie in a chaos of loose blocks, and are separated by heaps of stones on low granite bases. The lower lake is also confined on its other side by a rampart, under which its water flows, breaking out again far below to feed the Marica river.

Whereas lakes are of very rare occurrence in the mountains of the Balkan peninsula, they are very numerous in the Rila-dagh, being not fewer than 102, and measuring 90 to 1000 yards in length. The great majority, between 6900 and 7900 feet, are kar lakes. They have very transparent water of a green or dark green colour; only the two Banjska lakes in Razlog and the kar lake of the lower Leva Reka have a sky-blue colour. Being fed by melted snow, they have a lower temperature in summer, ranging from 43° to 61° F., and the temperature gradually increases from the uppermost to the lowest of the lakes in the same kar. For instance, the temperatures of the three Marica lakes are 46½°, 50°, and 59° respectively. In the higher uninhabited mountains there are no boats, but the water is so clear that the configuration of the bottom can in most cases be seen from the bank. They have, as already stated with regard to the Marica lakes, a shallow zone 16 to 50 feet broad, surrounding a deeper centre generally sinking to 16 to 30 feet, and the bottom is bestrewn with blocks.

Above 7900 feet are very small, shallow pools, confined to lofty saddles and broad ridges. They mark the sites of patches of snow which do not melt till late in the summer, and lie in hollows sunk in the ground by the action of firn and wind. Below 6900 feet the lake basins are connected with landslips and cones of dejection. The latter are the most effective agents in the filling up of lakes, both in the kare and in the valleys. Marsh plants play a subordinate *rôle*, though the lower lake of the Beli Iskar has been turned into a peat bog, and the Jelešnica is hastening towards the same fate. The greater part of the Sukho Jezaro has been silted up by its tributary.

The Rila mountains contain the largest snowfields of any mountains in the peninsula, and many travellers have remarked on their extensiveness. During the second half of July Professor Cvijić noticed some hundreds, most of them small, but several 400 to 700 yards in length, and one as much as 1100. The snow of the large firns has a grained structure, is compact and very thick, 25 to 40 feet. The snow-line must lie far above the mean elevation of the permanent firns, for 300 to 600 feet above them are extensive parts of the ridges where glaciers

could be developed. It probably is at the level of the highest peaks—that is, at about 9500 to 10,000 feet. In the Pyrenees, which are on the same latitude, glaciers occur at heights of 8900 to 9100 feet. In the Glacial Period the snow-line on the Rila mountains stood at 7200 feet, while in the Pyrenees its level was at 5500 feet, in the Eastern Alps at 3900 to 4200, and in the southern Jura at 3300. How many times the Rila mountains were glaciated there is not yet sufficient evidence to decide. The three terraces in the valley of the Černi Iskar and the successive moraines may belong to the same ice period. The Rila is the most south-westerly point in Europe where traces of glaciation have been discovered.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Election of Members.

At a meeting of Council held on January 27th, the following ladies and gentlemen were elected Members of the Society :—

Macdonald, Mrs. Norman.
Scot, Miss E. M.
Bertram, Wm.
Brown, Robert N. R.
Chatham, James.
Coats, Andrew.
Dick, Alan A.
Kennedy, Wm.
Mudie, Robert.
Sinclair, Dr. Robert.

Meetings held in January.

On January 18th Mr. W. S. Bruce lectured in Edinburgh, his address being entitled "With the Yachts *Blencathra* and *Princesse Alice* to the Barents and Greenland Seas in 1898." Mr. Robert Turnbull spoke briefly on Mr. Bruce's collection of the plants of Hope Island. Sir John Murray presided and conveyed the thanks of the audience to Mr. Bruce.

Mr. Savage Landor, who addressed the Society in Edinburgh last November, described his adventures in Tibet to the Glasgow Branch on January 12th. Mr. R. S. Allan presided.

The following evening Mr. Landor addressed the Dundee Branch. Mr. I. J. Weinberg took the chair.

Forthcoming Lectures.

Mr. Fred. W. Christian will address the Society in Edinburgh, on the Caroline Islands, on February 14th.

Mr. J. Y. Simpson will lecture this month on Siberia at Glasgow, Dundee, and Aberdeen.

Captain G. E. H. Barrett-Hamilton will deliver a lecture on Kamchatka early in March.

GEOGRAPHICAL NOTES.

By the Acting Editor.

EUROPE.

The Aven Armand.—A most remarkable stalactitic cave was discovered last year by M. E. A. Martel in the Causse Méjean, a mile and a half south of La Parade, and five miles south-east of Meyrueis (Lozère). A funnel-shaped orifice 13 to 23 feet deep leads to a vertical chimney 130 feet deep. At the bottom is a large oval grotto, 330 feet long by 165 feet broad and 115 high, with a steep incline. Into the upper part a considerable mass of *débris* has fallen from the opening; the lower is covered with a forest of some two hundred stalagmites. The largest stalagmite rises to a height of nearly 100 feet, another attains to 72 feet, while some thirty others have heights of 60 to 65 feet. No other cavern contains so many stalagmites, and, as to size, the highest before known, in the Aggtelek cavern in Hungary, is only 60 feet high. At the lower end of the cavern another pit descends vertically to a depth of 285 feet, so that the total depth is 679 feet, or, including the external funnel, 702. Consequently it rivals the Rabanel cave, near Ganges in Hérault, which M. Martel explored in 1889, and found to be 695 feet deep. It has been named Armand, after a locksmith who discovered it.—*Revue Française et Exploration*, October.

Land Reclamation in Schleswig-Holstein.—The struggle of the inhabitants of the fens with the sea waves has since last century almost always been attended with success. Except at the Halligen, till quite recently unprotected, which have lost considerably in area and population (see vol. viii. p. 545), there has been hardly any diminution, but considerable additions, to the cultivated lands. This has been especially the case in south-western Süderdithmarschen, where the alluvium of the Elbe, checked in its course by the tide, combines with the sand thrown up by the waves to raise the level of the coast banks. In 1579 the town of Marne adjoined the sea dyke, but by 1584 a long strip to the west of it had been reclaimed, and after the great flood of Christmas 1717, when the dyke suffered serious damage, more than 600 acres were added by reconstructing the dyke farther west. New accumulations led to further reclamations in 1785 to 1787, which, with the above 600 acres, made a total of 6300 acres. Also, towards the end of the sixteenth century, an island was formed in the sea, and in course of time a whole row of islands came into existence. After 1786 these were gradually connected by dams, and the intervening shallows were rapidly filled up. At length, in 1853-54, the whole area was enclosed by a dyke nearly fifteen miles long, so as to form a peninsula 5555 acres in extent. Another area of 2748 acres was enclosed in 1872-73, and many smaller plots have been protected sufficiently to render them available for summer pasturage, some of which it is now proposed to combine within stronger dykes, with a view to their permanent settlement.—*Globus*, Bd. lxxiii. No. 22.

ASIA.

Central Asia.—Professor K. Futterer and Dr. Holderer left Kashgar on February 24th, and, passing through the northern part of the Tarim basin, reached Aksu on March 10th; then, proceeding along the south foot of the Thian-shan, came to Kucha on March 22nd, Turfan on April 14th, and Khami on the 28th. Having got together a caravan of camels they started on May 6th along the direct

road to Su-chau, through the hilly part of the desert of Gobi. The journey through the desert lasted thirty days, and afforded abundant opportunities for geological observations on the structure of the elevations which cross the desert from west to east, as well as on the changes produced on the surface of the rocks by the climate and the wind. In the month of May the temperature, 0·4 inches below the surface of the ground, varied during the twenty-four hours as much as 72° F., and the range increased during the summer months. The centre of the hilly part of the waste consists of crystalline schists, granite and similar rocks, older Palæozoic sedimentary and old eruptive rocks. North and south of this solid and relatively high mass, about 150 miles broad, lie broad and comparatively low depressions, filled with rolled stones and *débris*, and running also east and west, which approach to the southern foot of the Tian-shan on the north, and to the northern foot of the Nan-shan on the south. In these two zones the highest temperatures and the greatest dryness of the air were observed. Large patches are covered with grass steppe on a loamy soil, while others are bare stretches of gravel. From Su-chau to Lan-chau the road followed at a distance the Nan-shan, and to Kan-chau the Great Wall, great heat prevailing and rain falling occasionally. In the Gobi there was no precipitation, except a snow-storm on May 17th. The travellers intend to pass by Si-ning-fu to the Kuku-nor and advance into northern Tibet.

Salt Lakes in Central Asia.—M. P. G. Ignatof spent last summer in examining the salt lakes of Akmolinsk, West Siberia. He began with the Kyzyl-kak, which is 10 miles long by 8 broad, and contains a large quantity of salts. Its temperature was 70° to 84° F., and at the bottom it was nearly 12° higher than at the surface. According to the Kirghiz it never freezes in winter. The colour of the water is red and bright carmine, owing, M. Ignatof believes, to the large number of crustacea it contains. In the neighbourhood are several fresh-water lakes, some of them several miles in diameter. How they come to be fresh is a mystery, unless the reeds on the banks have extracted all the salt from the water. The second lake, Selety-denghis, is 40 miles long by 16½ broad, and contains little salt. The conditions of temperature are much the same as in the lake just mentioned. The bottom is covered with decaying organic remains, and sulphuretted hydrogen is given off. The fauna consists of crustacea. The third lake, Teke, is 73 miles long by 10 broad, and is saturated with salt, and yet it contains several species of crustacea. No signs of drying up are perceptible, as in the case of the other lakes, especially the Kyzyl-kak. Permanently frozen soil was found 2½ feet below the surface at as low a latitude as 55° N.—*Globus*, Bd. lxxv. No. 3.

The Waterways of the Amur District.—M. V. E. Timonof, who was deputed to examine the means of navigation in this district, has published a short report in the *Izvestiya* of the St. Petersburg Geographical Society. He gives the following as the distances along the principal rivers which are navigable by boats:—the Amur, about 2000 miles; the Shilka and Ingoda, 660; the Argun, 330; the Zea and its tributaries, 1320; the Burea and its tributaries, 330; the Amgun and other tributaries of the Amur of secondary importance, 1660; the Sungari and its tributaries, 1320; the Ussuri, 660; and the Selenga, 660—total, 8940 miles. The waterways of the Amur have the great advantage of a very considerable depth of water: for instance, the channel of the Lower Amur, for a distance of fully 660 miles, is navigable by coasting vessels; on the greater part of the other waterways boats can ply having a draught of four feet and more. The period of navigation is only about five to five and a half months, but on the other hand there is most water when the rivers are open. There are, however, no insignificant

impediments to free navigation, such as banks, stones in the channels, and meanderings of the bed in some small stretches, and other obstacles more or less easily removed, though such removal is certainly necessary. Notwithstanding, steam navigation has sprung up, in response to the necessities of the district, on the rivers of the Amur basin and on the Selenga. In the year 1895, 56 steamers, with an aggregate force of 3269 horse-power, and 64 barges, with a total capacity of 11,285 tons, were employed in the Amur basin. Owing to the low value of money in Eastern Siberia and the absence of competition, the freightage is high, being even now, though the charges have been lowered, about $1\frac{1}{2}$d. per ton per mile for long distances, and rising to as much as $22\frac{1}{2}$d. for short distances. The progress in the construction of vessels has been slow, and, owing to the remoteness of the district from centres of the shipbuilding industry, the types of vessels selected have not generally been suitable to the conditions of navigation. The great distances over which the traffic extends, from Stretensk on the Shilka to Nikolaievsk on the Amur, demand vessels of various draughts, but it was not until 1892 that a new company thought of dividing the whole waterway into sections and placing suitable boats on each section. As yet this plan has been put into execution so far that different types of passenger and cargo steamers have been placed on the sections Blagoveshchensk-Nikolaievsk and Blagoveshchensk-Stretensk. There is great need of technical supervision of the navigation and of improvement in the channels by removing stones, deepening the shoals, putting down buoys, etc.

M. Timonof gives also details of the advantages each river affords for navigation, discusses the question where the port on the Pacific at the terminus of the Siberian railway should be situated, and concludes by recommending a rather formidable list of engineering works intended to facilitate navigation.

Peter the Great Range.—This range was discovered in 1878 by V. F. Oshanin, who saw it from the right bank of the river Surkhab. Its general direction is from east to west. To the west it gradually sinks, and at the bend of the Surkhab, where the river changes its direction from west to south, it comes to an end. The eastern half is very lofty, and but for the ravine through which the river Muk crosses it, it may be to a certain extent considered a prolongation of the Trans-Alai range. The length of the range in a straight line is about 100 miles. On the north it is skirted by the Surkhab and its tributary the Muk, and on the south by the Khingou, another affluent of the same river. Almost parallel to it on the north runs the most eastern part of the Hissar range and the western part of the Alai. From Ferghana it may be reached in four to five days.

About the middle of the range a slight bend marks a change in its character: thus far it is a single mountain range, but to the east of the bend it becomes a complicated system of chains and spurs. Here it encloses a whole series of large glaciers and bears traces of still more extensive glaciation in past times, and indeed changes its character altogether. Whether the bend has been caused by some tremendous force is not easy to say, but the following fact is interesting. Exactly at this bend lies one of the larger glaciers, from which flow two streams; the one, called in its lower course the Archa-Kapa, runs westwards into the Surkhab, while the other, flowing at first westwards, joins the Kulika, and, breaking through the lofty range, flows southwards to the Khingou. The fissure through which it passes runs almost west and east, and is one of the most interesting parts of the range—the Kara-Shura valley—being situated just where the two sections join one another.

M. Lipski, in 1897, approached the range from the south, proceeding from the

village Tabi-daria to the river Khingou, and thence by the river Shakou ascended to the Kamchirak pass (9000 feet high). Then descending to the Surkhab, he followed it up to the Liuli-Kharvi pass (12,500 feet), and finally by the valley of the Khingou came to the third pass, the Ghardan-i-Kaftar (13,000 feet). Judging by the height of the passes and other data, he concludes that the height of the range is not greater than that of the Hissar, and thinks that the highest points may reach 17,000 feet. There are no peaks towering conspicuously above the rest. The range presents a more imposing appearance from the northern side, as the snowy crest is not on that side concealed by flanking elevations, and can be seen from the Surkhab at a short distance. It is composed almost exclusively of sedimentary rocks—schists and sandstones, and, more rarely, limestones. The crest is formed by strata tilted almost vertically. These rocks contain a large proportion of iron oxide, which gives a red colour to a large part of the mountains. The northern and southern slopes differ thoroughly in character. The latter is rocky and is traversed by innumerable gorges, ascending to the very crest of the range, some of which are too precipitous to be ascended, whereas on the north, gentle slopes descend in terraces from the steep and lofty crest above. These terraces are traversed by streams flowing in deeply eroded gullies, with a considerable fall, and carrying a large amount of solid matter. They are of easy access and have no small population ; excellent grass grows on them, and corn, which feeds not only the local inhabitants, but also the neighbouring people in Darwaz. On the southern flank there are no villages except in the valley of the Khingou.

Karateghin, in which province the Peter the Great mountains are chiefly situated, has the reputation of being a poor country, consisting chiefly of rocks. This is the impression a traveller receives who approaches the centre of Karateghin by the beaten track, and descends the river Surkhab ; but if he turns upwards he will come upon a different scene. Compared to Darwaz, Karateghin is a paradise, and the natives of the former province are continually passing over to Karateghin in search of corn.

On the first day he enters Karateghin on the ascent to the Peter the Great range, the traveller perceives the difference. Approaching the Kamchirak pass (the most western) from the south, he first meets with fine arboreal vegetation, and higher up, about the pass and beyond, abundance of green rank grass ; and the same succession is repeated farther east. At considerable heights on these terraced slopes, where there is sufficient moisture, excellent grass grows, tall and succulent, and numerous flowers, forming splendid pastures. At the eastern extremity, in the glaciated region, a remnant of lovely Alpine vegetation is still preserved, which is now rarely seen in Central Asia. On the Kamchirak pass no glacier is seen ; on the next, the Liuli-Kharvi, there are two small ones—at least they have every appearance in the distance of being glaciers, and not snow-fields—while from the Ghardan-i-Kaftar pass eastwards extends a continuous region of glaciers. The whole upper part of the range is intersected by a series of ravines, descending northwards, and separated by ridges, each enclosing a glacier. These have all a peculiar character, quite different from the usual Central Asiatic type. Moreover, the whole region shows signs of much more extensive glaciation in past times.

Across the range runs the Kara-Shura valley, some eight miles long, watered by a sluggish winding stream, and containing three moraines of vanished glaciers, while a fourth, of enormous size, once skirting a still existing glacier, at the east of the valley, runs northwards. On the south side of the valley lies a small spur which gradually sinks towards the east. Through a cleft in this spur, just opposite the huge moraine, runs water from a glacier above. It is from this glacier that the water flows, as stated above, partly to the north and partly to the south of the

range. But the large moraine is also a watershed between the valleys on the east and west of it, so that waters from the neighbourhood of the glacier run in three different directions.

Mountain tarns are uncommon in Central Asia, but on the spur just mentioned there is a row of five lying on the axis of the spur, the highest being 12,000 feet above sea-level. Besides these there are other lakes, the largest, the Tunguyuk, being nearly 4 miles long by 3 broad. It lies at a height of 10,700 feet.

The glaciers differ from the usual Central Asian type. They lie in gently sloping valleys, extending like a stream or a tongue of ice, and in summer are not covered with snow. They are intersected by numerous moraines, and often accompanied by old moraines of large dimensions. Their extremities are quite exposed, and not infrequently they end in an arch, from which emerges a stream. Three of these glaciers M. Lipski describes very fully.—*Izvestiya* of the Russian Geogr. Soc., No. 3, 1898.

The Babuyanas, or Swine Islands, lie between Luzon and Formosa, separated from another group on the north by the Balintang Channel. The Babuyanas consist of five large islands surrounded by smaller islets and rocks. These islands are Camiguin, Fuga, Dalupiri, Calayan, and Babuyan or Babuyan Claro. The most important is Calayan, with an area of 14 or 15 sq. miles. It is covered with dense forest, contrasting in this respect with the Batan Islands, the inhabitants of which have to obtain almost all their building timber from Calayan. Nine streams descend from the mountains (perhaps volcanic) to the extensive and fertile coast plains, where their waters partially stagnate, breeding the malaria for which the island is notorious. Besides trees the *bejuco* reed, indispensable for thatch, grows in large quantities, and is exported to the Batan Islands. Horses, buffaloes, cattle and pigs swarm in the forests and plains, and the inhabitants have much difficulty in protecting their crops against their inroads. The people are Ilocanes, originating from Luzon.

Cavada Mendez de Vigo has given the area of the island Camiguin or Camiguing as more than 400 sq. miles, which must be accepted with reserve. It possesses a volcano, 3070 feet high, which was supposed to be quite extinct until 1857, when a fissure opened on its south-western flank. In Babuyan Claro there is also an active volcano. This island is about two-thirds the size of Camiguin, while Fuga and Dalupiri are each rather more than half. Cattle-grazing and fishing are the chief occupations of the inhabitants; on Camiguin and Calayan agriculture is pursued with some degree of care, and crops of rice, maize, yams and sweet potatoes are raised.

The chief islands of the Batan group are Batan, Saptan, and Ibayat or Itbayat. All the islands are mountainous and of volcanic character. The volcanoes, according to the missionaries, have broken through a layer of limestone. One of them, now extinct, is marked on Spanish charts as 3800 feet high. The climate is decidedly bad; dangerous fevers are endemic, and attack natives as well as Europeans. The mean temperature is lower than in Luzon, and in the months of November, December, and January appears cold to persons accustomed to the climate of Luzon. May to August are the dry months. Thunderstorms are not common, but typhoons are both frequent and violent, while earthquakes are natural in a volcanic region. Swift currents run among the islands, which, with the want of harbours and firm anchorage, renders navigation dangerous. All the islands are rocky, and have a meagre supply of water. A little rice is cultivated, sweet potatoes, taro and other roots, maize, sugar-cane, onions and garlic. Cocoa-nut palms thrive very well, and cotton also is a product of the archipelago.

Formerly it was supposed that the inhabitants of the Batan Islands were Ibanags, a people of northern Luzon, but now it is known that they have a language and customs of their own. They have all been converted to Christianity, except on Itbayat, where traces of paganism and a peculiar dialect are still perceptible. This dialect is spoken by the inhabitants of Botel Tobago, and it is possible that the Batan people of to-day at one time occupied the Babuyanas, while the original Batans took refuge in Botel Tobago. The Batans build houses of stone, wood being scarce. Their principal food is yams, though they also plant rice, sweet potatoes, etc. They keep cattle in large numbers, and still more numerous swine, which they export to Luzon, as well as onions. Fishing is a favourite sport, though fish are not very abundant in these waters compared to the other coasts of the Philippines. Many of the people emigrate to find work in Manila.

Since Dampier's time the islands have had the reputation of being rich in gold, whereas the missionaries now say that no gold is found on the islands. It is, however, a fact that old gold ornaments are very common.

The capital of the islands is Santo Domingo de Basco, commonly called Basco, on Batan Island, with a population of 2652, and two schools attended by 336 children. Magatao contains 1195, and Ibana 1914 inhabitants. 1735 persons live on Saptang, and 1080 on Itbayat.—Professor Blumentritt in the *Mitth. der K. R. Geogr. Gesellschaft in Wien*, Bd. xli. No. 9.

AFRICA.

The Rungwe Mountains, in Konde-land, north of Lake Nyassa, have hitherto been marked on maps as 8200 feet high. In August Herr von Elpons ascended to the highest peak. Passing through forest he came to bamboo thickets at a height of 6500 feet, through which a path had to be cut. The summit is steep, and covered only with large bushy ferns. Its absolute height is 10,170 feet. On the northern side the mountain falls steeply down to a caldron-shaped hollow, 2600 feet below, which Herr von Elpons believes to be an extinct crater. Along its bottom runs a fissure 100 yards broad, but whether it is of volcanic origin Herr von Elpons could not determine. The descent was made to the south-west, and the night was passed in a "chimney" 16 feet deep by 20 broad, the temperature falling to 43° F.—*Globus*, Bd. lxxv. No. 3.

Northern Madagascar.—The *Annales de Géographie*, July 15th, reports certain facts ascertained by French officers. There exists a very lofty northern plateau independent of the central mass, from which it is separated by a large and broad belt with a maximum altitude of less than 2000 feet, and not generally exceeding 1000 to 1300 feet. Here runs the great highway from east to west between the Betsimaraka and Sakalava, and which was commanded by the Hova fortresses of Mandritsara and Befandria. The northern plateau, according to Lieut. Boucabeille, attains, and even at some points exceeds, 6500 feet in altitude, and gives rise to several important streams; the Sofia, Maivarano, and Mahabavy all descend from the Bealana region. On the almost inaccessible heights live the Timiety. It is not known exactly where they came from, but the story connected with their name shows that they sought refuge here from political revolutions.

The lake Alaotra is very much nearer the east coast than the west, but it is separated from the former by forest, an obstacle to communication much more serious in Madagascar than distance, whereas the wooded belt that skirts Imérina on the east stops abruptly at the altitude of the sources of the Mahajamba.

Consequently, the valleys of the Mahajamba and Bemarivo constitute a natural highway between the districts of the Alaotra and Bouéni, and hence the Antsihanaka have spread as far as Bouéni. This facility of penetration of the western slope from the east has totally modified the character of the inhabitants. Though the natives of Bouéni call themselves Sakalava, they have no resemblance to the people of the Ambongo and Ménabé, but have in their veins the blood of the Betsimaraka and Antsihanaka, the most gentle and least warlike of the tribes of the island, who easily fell under the power of the Hovas.

While between Imérina and the true country of the Sakalava on the west there is a tract totally uninhabited, the zone between Imérina and Bouéni is peopled by Manendy, Marofotsy, and Antsihanaka, very sparsely indeed, for it contains only thirteen persons to a square mile, whereas in Imérina there is a density of 155.

As the soil of the sedimentary regions is far richer in fertilising constituents than the red clay of the east, the slopes of Ikaloka and Ambohipiriaka and the hills of Loky are probably the most fertile parts of Madagascar. Those who have seen the forests of the north say they are without rivals in the island. The whole region between Imérina and Bouéni, the country of the Manendy, Marofotsy, and Antsihanaka must receive during the summer very abundant rain, for the work of erosion is strikingly manifest. In winter the trade-wind attains the strength of a hurricane, and envelops the summits in fog and drizzling rain. This is the land of cattle ; enormous herds pasture there, tended by the few inhabitants. It is the larder of Imérina. It is also the land of gold. The placers of the Betsiboka and the Mahajamba have long been worked by the natives, and already the posts of prospectors are to be seen around Tsaratanana. A railway or carriage road would give new life to this country. With far less sacrifice of money and life than have been spent between Tananarivo and Tamatave, a carriage road might be constructed from Majunga to Tananarivo.

AMERICA.

Dr. Carl Sapper in Honduras.—On February 28th Dr. Sapper left Tegucigalpa for a journey in the eastern part of Honduras, making first for the mines lying to the east of the capital, the Santa Lucia and S. Juancito. The latter is the largest undertaking of the kind in Central America, and in 1897 yielded gold and silver to the value of more than £100,000. Dr. Sapper then proceeded in the direction of the mountains, past Jutigalpa and Catacamas, to the village of Culmi, and thence direct to Truxillo, which he reached on March 21st. The mountains on the route are of moderate height and, indeed, the east of Honduras is in general less mountainous than the west. Except a few summits in the northern coast mountains, the most important elevations are the S. Juancito and the Cerro de Chile, and these are scarcely higher than 6500 feet. Truxillo has lost much of its trade, which has been transferred to Ceiba and Puerto Cortez. East and west of the town are large Caribbean villages. On March 24th Dr. Sapper left Truxillo, crossed the coast range by the low pass of Zapote, and followed the broad valley of the Rio Aguan to the neighbourhood of the Jicaque village Agua Caliente ; then by a steep mountain road came to the Valle de Yoro, where he struck the main road, in many places only a wretched bridle-path, through Sulaco and Cedros to Tegucigalpa.

The roads in eastern Honduras are very bad, and must be hardly passable in the rainy season. Mules are almost exclusively used for transport ; the traffic on the rivers is very insignificant. The density of the population is much less

than in the west of Honduras. Most of the people are half-castes, and a mixture of negro blood is very common. The Jicaques, Payas and Sumos, the latter few in number, are the only pure Indians. Geologically the east is a complete contrast to the west of Honduras. Limestones, quartz conglomerates, sandstones and slates are, indeed, found in the east also, but late eruptive rocks are rare, while old eruptive and crystalline rocks are widely distributed both on the Atlantic coast and in the interior. Pine and oak woods cover the heights, bushy steppe and savannah the hollows. Damp tropical and subtropical forests occur only on the Atlantic coast, and on some of the mountain crests in the interior.—*Verh. der Gesell. für Erdkunde zu Berlin*, Bd. xxv. Nos. 5 and 6.

Puerto Rico.—Porto Rico, as it is commonly called in this country, has an area of 3596 square miles (about half that of Wales), and is 95 miles long by 35 broad. The population numbers 800,000 to 900,000, of whom about a third are Negroes. The imports, according to the returns of 1895, the most recent available, are of the value of about 3¼ million pounds sterling, and the exports of barely 3 millions. The latter consist chiefly of coffee and tobacco, while the imports are rice, fish, meat, flour, and manufactured tobacco. Spain sends more than half the imports, and takes a third of the exports. The United States are the second in importance among the countries Puerto Rico trades with, but in both cases the trade has somewhat diminished of late years. The most important towns are San Juan, Ponce, Mayaquez, Aguadilla, Arecibo, Fajardo, Naguabo, and Arroyo. San Juan stands on a long narrow island running out to sea in a rugged peak, on which is situated Castle Morro, the chief defensive work. This protects the harbour, which has a narrow passage, sometimes difficult and dangerous to pass, but the harbour itself is roomy and deep, and is perhaps the best in the West Indies. The houses are built of two stories, the ground floor being occupied by poor Negroes, and dirty and unhealthy. The whole population is dependent for its water supply on the rain collected on the flat roofs. Epidemics are frequent, and the town swarms with vermin. The population numbers 30,000. Ponce lies on the south coast on a plain two miles from the sea. It is well built, and contains 15,000 persons, mostly traders, while the people in the neighbourhood cultivate sugar cane, cocoa, tobacco, and oranges, and breed cattle. A good road connects it with the roomy harbour of La Playa. The climate is warm ; but thanks to the sea breeze and an abundant water supply, Ponce is the healthiest place in the island. Mayaquez, on the Mona passage, has an excellent climate and a considerable export trade. Thirteen miles east of Puerto Rico is Vieque, an island 21 miles long by 6 broad. The soil is fruitful, sugar cane is cultivated, and cattle are bred. The population is 6000. The capital, on the northern side, has a bad harbour, but Punto Arenas in the south has a good one.—*Deutsche Rundschau*, Jahrg. xxi. Heft 4.

Gold and Copper in Bolivia.—Don M. V. Ballivian is issuing from the Officina Nacional de Immigracion, etc., monographs on the mining industry of his country. In the first of these he treats, assisted by Señor José Zarco, of the gold deposits, after giving first a general account of the physical geography of Bolivia, its geology, etc. The auriferous districts may be divided into two great zones, of which one runs from the ranges lying to the north of the centre of elevation at Apolambo to the ranges of Chiquitos, while the other extends from these to the Puna de Atacama. Within this vast triangle the broad argentiferous zone of Bolivia runs parallel to the great chain of the Andes. At present gold is worked on a small scale only, but Don Ballivian affirms that the deposits would give a good return for capital expended on them.

Copper is found over an extensive area. The copper-bearing regions follow the eastern chain of the Andes from Atacama through the provinces of Lipez, Porco, Chayanta, appearing in Arque, Colchas and the department of Cochobamba, and extend north-eastwards past Turco, Poopo, and Oruro to Corocoro. Thence they spread through the provinces of Omasuyos, Muñecas, and Caupolican to Apolobamba on the confines of Peru. Besides these, deposits are found in all the spurs of the Andes, as, for instance, in the departments of Chuquisaca and Tarija. The exploitation of the mineral does not seem to progress. The quantity extracted in 1897 amounted to 2747 tons, of which 1480 came from the Corocoro mines, which in 1882 attained their maximum output of 3259 tons.

OCEANS AND GENERAL.

The German Deep-Sea Expedition.—A report of the work done by this expedition up to the time of its arrival at Victoria, Cameroons, is given by Dr. Gerhard Schott in the *Annalen der Hydrographie*, Heft 1, 1899. The first sounding was made on the Shetland-Färoer bank on August 6th, and on the 7th, after Suderö was passed, a series of temperatures was taken, which showed that the ice-cold Polar current had been found (31·8° at a depth of 328 fathoms); the dredge brought up a large quantity of the most important Arctic forms. On the 8th, on the other hand, in 60° N. lat. and 8° W. long., a great increase of warmth was revealed at all depths down to the bottom, where at a depth of 725 fathoms the temperature was 41·7°.

Then the *Valdivia* sailed for Rockall, but had to bear more to the east owing to stormy weather, and on the 14th made for the Josephine bank. A series of soundings was made between 36° 53′ and 36° 48′ N. lat., and between 14° 13′ and 14° 10′ W. long., and a shallowing of the sea-bottom discovered (depths of 971, 290, 187 fathoms), but not the 45 fathoms of the charts. Then the Seine bank was investigated, and temperatures were taken as well as soundings and specimens of the bottom; it was a singular discovery that at the edge of the bank in depths of 500 fathoms the ground was so hard as to injure the sounding tubes, while the bank itself was covered with a pure globigerina ooze even at a depth of less than 110 fathoms.

Having called at Orotava, the *Valdivia* sailed to the Cape Verd Islands, passing within forty nautical miles of Cape Bojador, and finding a surface temperature down to 69° F. At lat. 24° 43′ N., long. 17° 1′ W., 1356 fathoms were sounded and the bottom temperature was 38°. On the voyage to Cameroons not only the Guinea current, but also the northern branches of the cool Benguella stream, the origin of the South Equatorial Current, were to be investigated, and therefore a southerly course was held as far as 0° 9·3′ S. lat., and 8° 29·5′ W. long. Though the wind was remarkably constant in direction, the two systems of currents were easily identified. From the Cape Verd Islands nearly to the Equator the vessel crossed the eastward-flowing Guinea Stream, with warm dark-blue water of low salinity, and then passed into the South Equatorial Current, here flowing northwards. At the most southern point of the course, the temperature of the water, as high as 82° near the Cape Verd Islands, had sunk to 72° or 73°, and the salinity which had suddenly fallen in the Guinea Stream from 36·5 to 34‰, had gradually risen to 35·4‰, while the colour of the water had changed from deep-blue to greenish and the transparency had fallen from 100 to 40 or 50 feet. The course having been set east-north-east, the *Valdivia* again entered the Guinea Current in lat. 1° N. and long. 2° W. Many interesting observations were made at the limits of these two great currents, which differ not only in their physical and chemical

characteristics, but also in their animal and vegetable plankton and pelagic fauna. Much difficulty was experienced in taking the soundings, the wire rope being inclined at various angles by the drift of the vessel, and on one occasion carried by an undercurrent under the keel, so that a long length of rope and a thermometer were lost.

In all thirty-four deep-sea soundings were taken, most of them where blanks occur in the sounding sheets. The most important are given by Dr. Schott in tabular form; one of them, in 0° 9′ S. lat., 8° 30′ W. long., was 3114 fathoms, the deepest recorded under the Equator, with the exception of the doubtful one of the *Romanche* in 18° W. long. About twenty temperature series were obtained, most of them down to 550, 800, or 1100 fathoms, besides bottom temperatures, and of these also a table is given. They show that the heating of the water by solar radiation cannot be detected below a depth of 60 or 100 fathoms, while from about 300 fathoms great disturbances occur. At this depth the oceanic water on the parallel of Gibraltar is 11° to 14° warmer than at the Equator. The determinations of salinity agree with Prof. Krümmel's chart of the North Atlantic. An abnormal diminution was clearly perceived between the domains of the north-east and south-west trade winds. The salinity in the Gulf of Guinea, between 35·4 and 35°/₀₀, was maintained up to the mouth of the Niger.

Meteorological Work with Balloons.—M. L. Teisserenc de Bort recently reported to the Paris Academy of Sciences the results obtained by means of balloons sent up from his observatory at Trappes on June 8th. The first balloon, on rising from the ground followed a curvilinear trajectory, taking a westerly course. Little by little it turned northwards, and finally sailed north-east to Origny-Sainte-Benoite, where it fell, having traversed a distance of 100 miles in 3 hours 20 minutes. The second balloon, rising two hours later and starting westwards, turned by degrees to north 30° east, while the third fell towards the north-north-west following the lower wind. The temperature, which rose at first after the balloons left the ground, fell at the rate of about 1° F. for every 290 feet between 10,000 and 23,000 feet, the region where mists and clouds are formed, and at greater heights the fall was about 1° F. for every 237 feet. The curves of the second balloon showed the same variations. On the third balloon, which rose when the sky was overcast and rain was beginning to fall, the fall of the thermometer was 1° for every 335 feet from the ground to the clouds (11,000 feet), and 1° for 420 feet among the rain clouds; above 3¾ miles it increased again to 1° in 310 feet. The temperature fell to −74° at a pressure of 5·9 inches, corresponding to an altitude of 38,700 feet. The balloon continued to rise up to 42,000 feet, and the temperature at the highest point was −96°. The results obtained by these ascents are more reliable than most previous records, as those of the two balloons control one another, while the lagging of the thermometer behind the changes of air temperature was avoided. This improvement has been obtained by reducing the rate of ascension of the balloon by means of sand ballast and by protecting the thermometer from the radiation of the registering apparatus. To effect this the recorder was enclosed in a box with sides of cork.—*Ciel et Terre*, August 16th.

On August 24th MM. Hermite and Basançon sent forth their little balloon from the Champs de Mars. It rose vertically to a height of 3300 feet, and attained a maximum elevation of 33,000 feet. The temperature at the highest point was −58° F., while on the ground it was 86° F. in the shade, so that the fall was about one degree for every 230 feet. This rapid decrease explains the remarkable cooling of the air after the storm on the 23rd.—*Revue Scientifique*, September 17th.

MISCELLANEOUS.

The Société Khédiviale de Géographie has established a geographical and ethnographical museum at Cairo.

M. Delebecque has recently examined several lakes in the Pyrenees and Alps. The results are given in pamphlets he has forwarded to the Society. The lakes here treated of are of small area, and most of them are of glacial origin, but one or two are Karst lakes.

Captain Deasy has been travelling in Central Asia. From Yarkand he crossed the Aksai-chin desert to Polu, discovering on the way the sources of the Khotan-daria in 35° 35′ N. lat., and 81° 40′ E. long.

Dr. Sven Hedin intends to make another journey in the same region. He will again start from Kashgar, and having crossed the Takla Makan desert by a new route, will pass through Tibet to India.

The annual meeting of the Geographical Association was held on January 11th at the College of Preceptors. The Hon. Sec., Mr. B. Bentham Dickinson, read the report, which showed that the Association was growing steadily in numbers and influence. The memorial to boards of public instruction (see vol. xii. p. 326) had been favourably received by the Central Welsh Board for Intermediate Education, and the answers from various examining bodies in Scotland expressed sympathy with the aims of the Association. In England it had in several cases led to a marked improvement in the character of the questions set. With regard to a syllabus, it had at length been decided that the Association should not give its authority to any, but encourage teachers to unfold their own ideas derived from practical experience. Several papers on the subject had been published in the American *Journal of School Geography*, which the Committee had done their best to make known to British teachers. Much remained to be done before the Journal could meet the requirements of teachers in this country, and the Committee appealed for help in this work to all who are interested in geographical education. There was also need for more lectures to keep pace with the growing interest in geographical subjects in the country.

In moving the adoption of the report, Mr. A. D. Carlisle (Haileybury) spoke of the value to teachers of the Association's collection of lantern slides, and Mr. H. J. Mackinder expressed his satisfaction at the refusal of the Committee to issue a syllabus.

The president, Mr. Douglas W. Freshfield, then delivered a short address, and Mr. A. W. Andrews illustrated the use of the lantern in teaching by the exhibition of slides accompanied by a few words showing the special feature each brought into prominence.

NEW BOOKS.

Les Français d'Aujourd'hui. Par Edmond Demolins. Paris : Firmin Didot. 1898.

Though not so well known in Scotland as he deserves, M. Demolins has been a frequent visitor to Edinburgh, having in three or four recent vacations taken an active part in the August Summer Meeting, of which the social and geographic teaching, thanks largely to his influence, has always been strongly tinctured with the teaching of his master Le Play. His characteristic figure and racy personality, with

all the wit and eloquence and daring logic of the meridional type, might sometimes have made his colder northern audience suspect a touch of Tartarin, were these not as constantly balanced by a penetrating yet sympathetic criticism like that of Tartarin's creator, and a substantial geographic and social knowledge and insight beyond that of contemporary critics and men of letters. In his visits to this country he has also been greatly impressed by the new schools of the type of Abbotsholme and Bedales, in which technical, geographic, and modern studies are at length so largely replacing the time-worn curriculum. Thus prepared, he has written a series of three books, a sort of educational trilogy. Of these the first —*A quoi tient la Supériorité des Anglo-Saxons?*—was unquestionably in France the book of its year, and not only aroused the keenest discussion, but sent a wave of sympathetic interest in Britain over the whole country, as yet probably unparalleled in international literature. The second of these books is that before us ; while the third (*L'Education Nouvelle*) proposes better schools and new methods in France, of the outcome of which geographers as well as educationists may yet hear more.

But what of this book itself? To many geographers it may at first seem hardly geographical at all ; it tells us few or no new facts about either the physical or the social geography of France, and indeed its treatment of these must not infrequently shock the specialist as bold to rashness, as broad almost to superficiality. Yet for geographers of a younger school it is none the less a vital and notable book. This vital element, by which the book may not only live its day, but take date by wide suggestiveness for many lands, is that it traces out more clearly and boldly than any book before that association of Regional Survey with Economic Interpretation in which M. Demolins is so forcible and convincing an expositor of the doctrines of his masters, Frederic Le Play and his still less-known successor M. de Tourville. The ways in which environment determines occupation, and occupation in its turn determines social conditions, family organisation, and political life, are here traced out with admirable (and in the main convincing) force for region after region, and are often followed into shrewd and subtle criticism of the qualities and defects of racial character and even individual type and education—into practical suggestion also. This doctrine of the relations of man and his environment, some will say, is only that with which we have been familiar since the days of Montesquieu. Granted so far, yet the value and suggestiveness of the restatement to each generation is not surely to be disputed, else Conte, Spencer, Taine have written in vain. The historic importance of Le Play is to have restated this with a new concreteness, while M. de Tourville and his little band of observant workers and expositors (among whom M. Demolins is chief) continue this in their turn with more exact method and into regional detail. That their method and classification may still be far from satisfactory, just as their regional observation is far from complete, few will deny ; none the less it is time that whoever sees any unity between physical and social geography should know something of the work of Le Play, and still more of the school of younger workers who are not only following in his footsteps, but are exploring beyond them.

The book may be strongly recommended on grounds of its general suggestiveness to those who desire to know something of France, which means knowing her province by province, and Paris not first, but last of all. It may be recommended also, and perhaps even more strongly to those who feel the interest of making similar regional interpretations in their own country ; while, returning to grounds of general geography, its synthetic and truly evolutionary character will enable it safely to outlive any of the exceptions which may here and there be taken to particular theoretic conclusions or points of detail.

No country, of Western Europe at least, is better adapted for such an Interpretative Regional Survey than Scotland, for perhaps in none is the theatre of those hunting, pastoral, agricultural, fishing, mining, and other elemental activities, on which it is the special habit of the Le Play school to insist (as of far greater importance than the race factors which have been so long and so unduly emphasised), better marked or more complete ; nowhere probably have their characteristic communities been longer and better isolated, nor these more characteristically opposed or intermingled. Who then will follow M. Demolins' example, and write for us "The Scotsmen of To-day ?"

L'Algérie et la Tunisie. Par Paul Leroy-Beaulieu, Membre de l'Institut, etc. Deuxième édition, remaniée et augmentée. Paris : Guillaumin et Cie., 1897. Pp. 620.

The new edition of this important work has all the interest and value which was to be expected from the work of a writer who has not only a personal acquaintance with the country, but is, besides, an economist of European reputation. He writes throughout as a critic, and he criticises the past administration of the colony very freely. Perhaps its chief need, he says, is decentralisation ; the present system of attaching the colonial bureau to the corresponding bureau in the metropolis recalls, he considers, the faulty system of the old Spanish-American colonies. He desires to see an "autonomie administrative, qu'il faut bien distinguer de l'autonomie politique." This should lead to the correction of past mistakes, and their avoidance in the future. Representation in some form must be extended to the native races, and not confined to the Europeans. The expropriation of native lands has been a source of hardship and disaffection, the intention being to substitute individual for tribal property in land, and thus to improve agriculture, while retaining collective responsibility. He points out the great superiority of the Kabyles, who have individual ownership in all that relates to agriculture and stock-raising. The Kabyles, too, are monogamous. The object of polygamy among the Arabs, he says, is to obtain the domestic labour of the women, and he would accordingly combat it by making it cheaper to go to the open market for what the women now produce at home. He mentions as one cause of impoverishment to the country the expropriation of the cultivators by Jewish usurers. And meanwhile the general result of the governmental system is seen, he says, in the feelings of distrust and hostility with which the different classes regard each other.

The annual expenditure on public works, exclusive of railways, averages 6,700,000 francs. The writer finds here, and also in the railway department, a good deal to disapprove ; still the results, especially in the railways, are very considerable. He takes, however, a very sanguine view of the future. The European holdings of land increase by one-sixth annually, and an area of about 1,383,000 hectares now supports some 200,000 colonists. Of the leading industry, viticulture, he gives full statistics. The production of wine has risen from 17,000 hectolitres in 1879 to 114,000 in 1895, when it was checked by the phylloxera. Up to 1886, however, the import into Algeria exceeded the export. And it is not generally known that the produce of the vine in Algeria is less than in the south of France.

The reader will turn with especial interest to the chapters which deal with Tunis, for the ten years which have elapsed since the first edition of the book appeared embrace a large proportion of the history of the French occupation. Tunis made a fortunate start, under a governor who, according to our author, knew the evils

of haste, and disliked ostentation, and still more "le formalisme bureaucratique" (Anglicè, red tape). Too much was spent, or, as the writer considers, mis-spent, on expensive roads, for the physical conditions of the country are different from Algeria; the plains of the littoral are very extensive, and the valleys which intersect them are wider, and their slopes gentler. Thus there were already tracks across the plain country, *e.g.* from Gabes to Gafsa, and from Gafsa to Tebessa, passable by wheeled vehicles. But a great and successful work is the improvement of the port of Tunis, which is now, at a cost of fifteen millions of francs, directly accessible to large sea-going vessels, by means of a canal through the lake. It may be easily understood that we have only alluded to a small proportion of the various topics of interest ably dealt with in this volume.

The Gold Coast, Past and Present. By GEORGE MACDONALD, late H.M. Director of Education for the Gold Coast Colony, etc. London: Longmans, Green, and Co., 1898. Pp. 352. *Price 7s. 6d.*

In this book we have an interesting *résumé* of the history of one of our least-known colonies, and also a detailed description of its physical features, climate, resources, trade, and people. The Gold Coast from time to time, and from one cause and another, has been subdivided into a score of what we may call counties or districts, but they do not differ from each other in their general features to an extent which calls for a separate description of each. Mr. Macdonald, however, has treated each separately in detail, which now and then becomes wearisome, and this part of his work might have been considerably condensed without detriment to its general usefulness. On the other hand, if any of our readers desires to know all about one part of the colony to the exclusion of the rest, he will find what he wants in this book.

The materials for the early history of the colony are extremely meagre. Tradition and legends indicate that the present inhabitants of the Gold Coast are the descendants of tribes who originally dwelt inland and were driven south and west from the interior, until the sea proved an insuperable barrier to further movement. Tradition also asserts that the Phœnicians, and after them the Carthaginians, traded with the tribes scattered along the Gulf of Guinea; but all trustworthy records of this have disappeared. The honour of being the first in modern times to discover the Gold Coast is disputed by the French and the Portuguese. However this may be, they were soon followed by the English, the Dutch, and the Danes, each of whom erected forts whenever and wherever they were in a position to do so, and vied with each other in the scramble for gold, ivory, spices, and slaves. The Portuguese withdrew from the struggle about the middle of the seventeenth century; but it was not till well within our own time that by international agreement with the Dutch and Danish Governments there was an interchange of territories, and the English colony was constituted as it now is. The history of the interior was probably one of continuous intertribal war and disturbance till the present day, or at least till the deposition of King Prempeh in 1896.

The exploration and development of the colony is undoubtedly one of the most difficult problems which it falls to the lot of the British nation to solve. The initial difficulties lie on the surface. There is a pestiferous deadly climate with which strong men, however moderately and wisely they live, seem unfit to cope. Then the anchorage and coast are most dangerous to all kinds of shipping, and there are but very few places where it seems possible to construct harbours. The inhabitants are sunk in profound degradation and superstition, and, with few

exceptions, are incorrigibly untruthful, idle, and lazy, so that all important and constant work has to be carried out by imported labour, generally Chinese. Even now they are but little removed from gross barbarism, and if the strong arm of the British were taken away, they would speedily relapse into their former condition. On the other hand, there is no doubt but that the natural resources of the country are enormous. In the first place, nearly the whole of its area is auriferous, and it has been calculated that some seventy millions sterling of gold have already been exported from it. The extraction has always been most primitive, being hindered by various causes unknown in other gold-bearing localities. With settled times, good machinery, and imported labour, the out-turn of gold from this colony should, however, rival that of any other part of the continent. Ivory can no longer be included in the list of the resources of the colony, as elephants are now rare, nor, of course, can slaves. But there are immense stores of valuable timber, nuts, oils, guttapercha, and spices, and plenty of land which, when cleared and properly prepared, would be suitable for coffee, cacao, etc. Evidently the first and most urgent want of the colony is good harbours; and after that good means of internal communication, viz., roads, bridges, and railways. Until these are forthcoming, there can be no great increase in trade and commerce. There remains, however, the deadly climate, and although the clearance of the forest and jungle, and the enforcement of habits of cleanliness and sanitation among the people will do much to modify the pestiferous malaria, it is at least doubtful if the colony will ever become what can justly be called a healthy place for Europeans.

Nine Years at the Gold Coast. By the Rev. Dennis Kemp. London: Macmillan and Co., Limited; New York: The Macmillan Company, 1898. Pp. 279. *Price* 12*s.* 6*d. net.*

This volume is written for the perusal of but a limited number of readers, viz., the supporters of the Wesley Missions on the Gold Coast, and the young men who are in training for work abroad; and so we do not expect, nor do we find, in it any indication of original exploration or research. It might be fairly described as a defence or apologia for starting and continuing missionary work in a locality where nature seems to have pronounced an irrevocable decree that no white man shall live. Apparently no white man, however judicious and careful he may be, can escape the deadly malarial fever of the Gold Coast, and his only recourse when stricken down is to return to Europe. "On the homeward voyage," says Mr. Kemp, "a Government officer informed me that out of fifty Europeans who were at Cape Coast two years previously, only five were alive that day; which statement reminded me of the fact that an officer connected with the Ashanti expedition was informed that out of twenty who dined at the house of a British merchant on Christmas Day, 1894, only two were alive on the following Christmas Day." Such statistics are astounding, but they are not disputed by the author, and are even confirmed by the personal experiences which he describes. Not the less, however, is he enthusiastic with regard to the necessity and expediency of perseverance in, and increase of, missionary effort, and he points out with pardonable pride and satisfaction the good results which have already attended the spread of the Gospel. We fear they will seem to many to be small and disproportionate to the amount of good men and treasure expended in bringing them about, but on the other hand we cannot fail to honour the brave and devoted men who, like Mr. Kemp, deliberately take their lives in their hands, and continue an arduous and in many ways an ungrateful task, knowing that their reward is not of this world. The volume is well illustrated and has a useful map.

Camping and Tramping in Malaya. By Ambrose B. Rathborne, F.R.G.S. London: Swan Sonnenschein and Co., Ltd., 1898. Pp. x + 339. *Price* 10s. 6d.

In this book Mr. Rathborne describes some of his experiences as "an emissary of civilisation" among the native states in the south-west of the Malay peninsula. Apparently his original intention was to settle down there as a coffee planter, but circumstances changed his career into that of a road surveyor and engineer. For fifteen years he was employed in aligning and making roads which, as he himself tells us, have now for the most part been superseded by railways; and his descriptions of the country he had to traverse, the peoples with whom he had to deal, and the difficulties, climatic, physical, and others, which he had to overcome, are set forth in simple and natural terms which impress the reader with the conviction that he is reading "a plain unvarnished tale" in which there is no exaggeration. In fact the story as told has but little to recommend it in the way of exciting adventure. Mr. Rathborne seems to have had very little sport with which to vary the monotony of his work, and to have had few if any adventures with tigers or bison or even snakes, such as we generally find in jungle books. He does not present to us the inhabitants of the peninsula in the lurid light by which we see them in the pages of Mr. Clifford's *Studies in Brown Humanity*, but he indicates that his task in dealing with the natives was often delicate and dangerous, and it speaks well for his own tact and presence of mind that he accomplished his work with so little friction. Throughout his pages we learn much about the difficulties which beset the path of the British officials who are now engaged in exploiting as well as governing the country, and we see how these difficulties are being steadily overcome by perseverance, tact, and judicious administration. But we lay down the book satisfied, from Mr. Rathborne's description and experience, that however rich it may be in guttapercha, metals, etc., the South-Western Malay peninsula is not a country for a white man to live in.

The illustrations, which are by Mr. Wise, are good so far as they go. There is also a useful map. If the book ever reaches a second edition, Mr. Rathborne should revise the spelling of proper names, so that the map and the letterpress may correspond to each other.

Cave Regions of the Ozarks and Black Hills. By Luella Agnes Owen. With Illustrations and a Map. Cincinnati: The Editor Publishing Co., 1898. Pp. 228. *Price* $1.50.

These regions lie respectively in the States of Missouri and South Dakota, and offer special attractions to the speleologic enthusiast. The Wind Cave in the Black Hills, for instance, contains ninety-seven miles of explored passages and halls, and most of these are endowed with all the beauties of form and colour of which dripstone is capable. There is interest, besides, in the animal life, eyeless and sometimes toothless, and in the antediluvian remains. The writer describes her experiences when visiting the caves at greater length than is required by the ordinary reader, but with some humour, as when she complains of the peculiarity of cave ropes, which will sustain a 200-lbs. man, but at once grow weak when threatened with 100 lbs. of woman's weight, or in explaining that a "Devil's Punch Bowl" had had its bottom knocked out, as South Dakota was at the time a prohibition State. The geological problems involved are dealt with largely in the language of official reports, and are of considerable variety, but the field of comparison might have been enlarged with advantage. The extreme beauty of some of the dripstone formations may be gathered from such illustrations as "The Chimes," and "Blondy's Throne."

A Midsummer Ramble in the Dolomites. By Amelia B. Edwards. London: George Routledge and Sons, n.d. Pp. xxiv + 389.

Most of our readers are no doubt familiar with the name of the authoress, and many are probably acquainted with the title, at least, of the book. It describes in an attractive style the country and people as seen by the authoress five-and-twenty years ago, and may be read with interest and advantage by those who have visited the picturesque district of the Tyrol, as well as by those who desire to gain an idea of its physical peculiarities. The present volume is a reprint from the second edition of 1889, to which was added some information useful for tourists. The volume is well got up, and illustrated with good engravings.

Die Verteilung des Niederschlags auf der festen Erdoberfläche. Von Alexander Supan. Gotha, Perthes: Dr. A. Petermanns Mitteilungen, Ergänzungsheft Nr. 124, 1898. *Price 7 m. 40 pf.*

The editor of *Petermanns Mitteilung* has added another to his many services to geography in this new *Ergänzungsheft*. It was time that a new annual rainfall map was issued, and Dr. Supan has taken the opportunity to do more than this. In this monograph we have a collection of invaluable tables giving annual monthly rainfall means for the most important stations outside Europe, and in the cases of countries where the stations are few all the data available. The figures are all expressed in millimètres, and are therefore readily comparable. The annual means have been used in the preparation of the map of mean annual rainfall. The tables also form the basis for six original maps, all of which are distinct acquisitions to the geographer. Four maps show the mean rainfall in each of the four seasons; a fifth map gives the limits of regular rains and persistent droughts; and a sixth is coloured to exhibit the areas where most rain falls in the winter half year, and those where most falls in the summer six months, in addition to indicating the range of rainfall found by expressing the difference between the precipitation of the maximum and minimum months of each station as a percentage of the annual mean.

The map of mean annual rainfall, while showing a general resemblance to Professor Loomis's map as revised by Dr. Buchan for Sir John Murray's paper *On the Total Annual Rainfall on the Land of the Globe* (*S.G.M.*, vol. iii. p. 65), gives more detail and precises the trend of the equal rainfall lines. Six areas are distinguished. The regions of drought, with an annual rainfall of less than 250 mm. (10 inches), extend over the desert areas of tropical regions, and beyond the polar circles. The areas of moderate rains, from 250—1000 mm. (10—40 inches), occupy all lands between the tropical and polar circles, except the west coasts and high mountains in the regions of west winds, and the east coastal regions of monsoon winds, which are regions of heavy rainfall (over 1000 mm. = 40 inches). The moderate rainy areas are subdivided into three, and the areas of heavy rainfall into two. The regions of heaviest rains are found in an equatorial belt, and north and south therefrom there is a regular gradation to the deserts.

These desert regions are those of permanent low precipitation, whereas the equatorial rain-belt, the west storm wind areas, and the lofty east coasts facing the permanent trade-winds are areas of steady rains.

The summer rains are greater than winter rains, as both maps of seasonal rainfall and of winter and summer rainy regions show; and autumn rains are heavier than spring rains. The winter rains are coastal rains, or mountain rains, and are mainly found in the polar halves of the temperate zones, or in the east coast trade-wind regions just mentioned.

The range of rainfall is naturally least in these areas of constant rains, and greatest where the periodicity of the precipitation is most marked.

It is quite impossible in a brief review to do more than call attention to Professor Supan's work, one which every geographer will turn to again and again, whenever he has to do with any problem involving a consideration of rainfall. It is full of valuable data, illustrated by clear maps, and accompanied by letterpress which is much more than a mere description of the maps, for it states and attempts to solve many problems relating to rainfall.

Twelve Indian Statesmen. By George Smith, C.I.E., LL.D., etc. Second Edition, with Portraits. London: John Murray, 1898. Pp. 324.

No one will be surprised that Dr. George Smith's *Twelve Indian Statesmen* has reached a second edition. The intrinsic interest of its subject, its light and graceful style, the exceptional personal knowledge of the writer, are a combination which more than accounts for the ready and hearty acceptance it found with the public, who were quick to recognise the light it threw on the history of some of the most interesting and exciting episodes of recent Indian history, and on the problems of Indian administration in general. We must add that the new edition has been enriched by portraits of all of the statesmen whose careers have been sketched.

Sir Henry Lawrence, the Pacificator. By Lieutenant-General J. J. M'Leod Innes, R.E., V.C. With Portrait. Oxford: The Clarendon Press, 1898. *Price 2s. 6d.*

General M'Leod Innes, himself a distinguished soldier, has written a soldier's life of Henry Lawrence. After the first volume of the great biography of the greatest Irishman who ever went to India—Colonel Wellesley not excepted—which volume Sir Herbert Edwardes wrote and then went over to the majority, no one may successfully attempt the life of the Provisional Governor-General of India in the Mutiny. But if it be admitted that General M'Leod Innes has failed to picture for us the man as Edwardes did, we have here a lucid, nervous, and well-drawn narrative of the official, the "political" as well as the soldier. Even if we incline to the other side in the controversy between Dalhousie and Henry Lawrence, we must admit the fairness of our author's statement of the case. Not less fair is his treatment of the Karauli adoption question, and the annexation of Oudh. The remarks on Lord Canning's early inability, or unwillingness, to comprehend the Mutiny crisis, on pages 164-165, are the more valuable that the truth has seldom been so judiciously told. The characteristic portrait of Henry Lawrence, taken in 1857, not long before the end, is worth the price of this second supplementary volume of the Rulers of India Series.

The British Empire in the Nineteenth Century. Its Progress at Home and Abroad, comprising a Description and History of the British Colonies and Dependencies. By Edgar Sanderson, M.A. (Cantab.). Six vols. London, etc.: Blackie and Son, 1897-1898.

The British Empire in the Nineteenth Century is a book we can recommend to the general reader as a very interesting and useful compendium of the history of the period, and especially of the development of our dependencies, and of the progress of literature, science, and art in the time. It is a book not so much for a single perusal, though very rewarding even in that respect, as for buying and having beside one for reference. There is a good index, which makes its contents readily available. The information given is, as far as we could verify it, accurate,

and the details are just such as an intelligent reader—we would not say student—of history would desire to have. The narrative is spirited and often picturesque, and the reader is carried on from page to page by a style clear, easy, and attractive. There are six volumes, printed in good type, and on excellent paper. The first and part of the second are introductory, and contain a condensed account of the history of Great Britain in the eighteenth century, with a description of the founding of our Indian Empire, and the rise of most of our colonies. The remainder of the work is occupied with its subject proper—the nineteenth century, and contains in the first place a civil and military history of Britain, embracing such subjects as home affairs, foreign policy, various wars—the naval engagements being especially well described—and our relations with the United States and Ireland. In the remainder of vol. ii. and vol. iii. we have chapters specially devoted to progress in nearly every sphere of government and social life, such as lighting, mining, free-trade, poor laws, manufactures, shipping, railways, philanthropy, sanitary reform, etc. The remaining volumes take up India, Canada, Australia, and our other colonies, following very much the above lines, and are full of valuable and interesting information. The key to the tone and spirit of the book may be found in chapter xxvii. They are to the credit of the writer. The illustrations are a little disappointing in the choice of subject. Better maps, authentic portraits, and correct representations of places and scenery would have been more in keeping with the character of the book.

Imperial Britain. A Comprehensive Description of the Geography, History, Commerce, Trade, Government, and Religion of the British Empire. In Two Volumes. With Maps and Illustrations. Vol. I.—The British Empire in Europe, etc. By the Rev. THEODORE JOHNSON. London: The Imperial Press, Ltd., 1898. Pp. 295.

This is one of those perplexing publications in which the aim is indefinite and the result bewildering. It has neither the merits of a school geography nor the interest of a readable descriptive handbook. One can only characterise it as a compilation of varied information, largely indebted to Meiklejohn's *Geography*, *Imperial Institute Journal*, Whitaker's *Almanac*, etc. It contains many interesting facts from these useful authorities, but nothing new to justify its appearance under such a pretentious title. The scheme of the Imperial Library is a very commendable one, but if such an ambitious project is to be worthily carried out it should be intrusted to writers with more special qualifications for such work.

Studi giuridici e politici. Il Commercio del Mondo. Sguardi storici. Di GAETANO SANGIORGIO. Milano: Ulrico Hoepli, 1898. Pp. vii + 618.

In a series of eloquently written essays, the author describes the development of the chief countries of the world through the instrumentality of industries and commerce. Dealing separately with each nation or natural group of nations, he shows how commerce grows, flourishes, and decays, in close sympathy with the vicissitudes of the body politic. He deals with the subject in a very impartial spirit, not shutting his eyes to the shortcomings of his own nation, and always ready to acknowledge superiority in whatever nation it may show itself. Speaking of Great Britain, he says: "Il Panbritannio terrà . . . il primato nel mondo, e l'aristocrazia dell' umanità sarà sua." But he objects to British interference in the Mediterranean, where, he thinks, Italy has a natural right to be regarded as the paramount power. Of special interest are the author's views with regard to recent developments in his own country. He condemns, in the strongest terms, Italy's

African policy. Bureaucracy and the despotism of financiers and banks, "cesarismo finanziario," as Ferrero has called it, he considers the chief curses of modern Italy; but he is confident that a policy of peace, retrenchment, and reform will re-establish Italy's position among the foremost commercial nations of the world.

Aarbog for Dansk Kulturhistorie, 1898. Udgiven af Poul Bjerge. Aarhus: Jydsk Forlags-Forretning, 1898. *Pris* 2 *kr.*

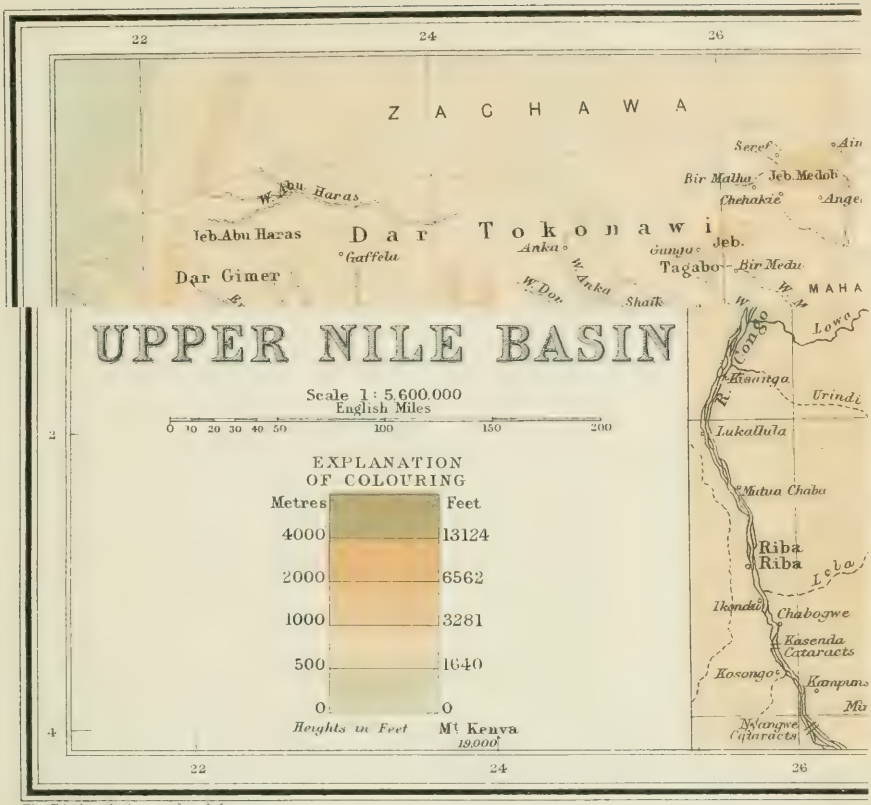
Perhaps the most interesting of the articles contained in the current number are those on conundrums by H. F. Feilberg, who gives the variations they assume in different countries; *For Halvhundrede Aar siden*, in which Jan Schjørring narrates some events in Copenhagen in the year 1848, and his experiences with a volunteer corps; and *Bondeliv*, by E. T. Kristensen. The last is a very complete description of the farmer's house fifty years ago, and his mode of life. Unfortunately, small domestic details are too often considered beneath the notice of the historian, and in these rapidly changing times we are in danger of losing all knowledge of the way in which our forefathers lived.

Coffee and Indiarubber Culture in Mexico. Preceded by Geographical and Statistical Notes on Mexico. By Matias Romero. New York and London: G. P. Putnam's Sons, 1898. Pp. 417. *Price* 14*s.*

Until his health gave way, the author served from 1868 to 1871 as Secretary of the Treasury in Mexico, after which he embarked on coffee and indiarubber culture, as he found these to be "the most promising and profitable undertakings" in Mexico. Less than a third, however, of the work under review describes coffee and indiarubber culture, valuable geographical and statistical chapters on Mexico forming its chief contents. Although the author admits that "all circumstances and conditions of coffee-raising have materially changed" since he wrote nearly a quarter of a century ago what he here publishes regarding coffee culture in Mexico, he pleads that he has not found time to revise his paper, a plea which cannot be considered satisfactory by his readers. Since his description of coffee culture in Mexico was written, "the price of land has increased twenty times, as a caballeria which was worth $50 in 1874 has been recently sold at $1000. Wages have gone up twice or three times higher than they were then, and all the estimates of the costs and expenses, to be approximate to present conditions, would be required to be at least triple, and, in some cases, even this figure would not represent the exact cost." As a present-day exposition of coffee culture in Mexico this work is therefore untrustworthy on the author's own showing.

The same remarks unfortunately apply to the author's paper on indiarubber culture in Mexico. He purchased a rubber plantation in 1873, but he abandoned it in 1875. His paper was written over a quarter of a century ago, and he candidly admits that "the estimate of the cost of a plantation, while perfectly reliable in 1872, would be subject to serious changes"; adding, "In so far as the profits are concerned, I would be still more conservative, and reduce them very materially." Then the author continues: "As I am the only one who has written on indiarubber culture in Mexico," forgetting that the despatch of Sir H. N. Dering, British Minister in Mexico, to Lord Salisbury (*F. O.*, 1895: *Miscellaneous Series, No.* 385) contains an article by The Mexican Information Bureau (Mr. Yorba and others) on "The Mexican Rubber," which Sir H. N. Dering thought very valuable.

Although there is a good map of the valley of Mexico, there is no general map, which is the more regrettable as the author had unusual opportunities of obtaining or editing a superior map of Mexico. A geographical description without a map is like a biography without a portrait.



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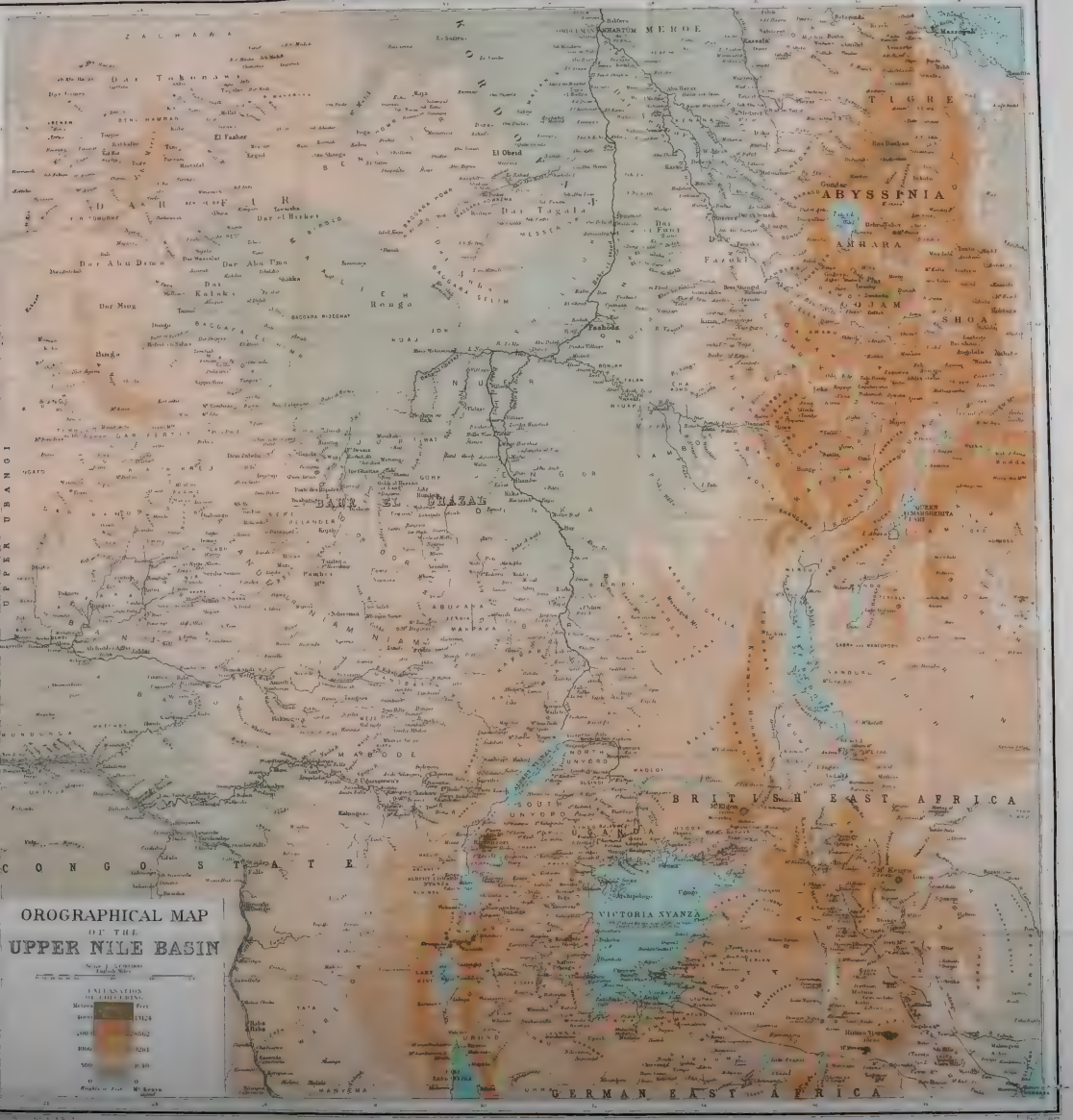
OROGRAPHICAL MAP
OF THE
UPPER NILE BASIN
EXPLANATION
OF COLOURING
ABYSSINIA
BAHR EL GHAZAL
BRITISH EAST AFRICA
GERMAN EAST AFRICA
CONGO STATE
VICTORIA NYANZA
KHARTUM
MEROE
TIGRE
AMHARA
SHOA
DARFUR
KORDOFAN
NUBIA
UPPER UBANGI

THE SCOTTISH

GEOGRAPHICAL

MAGAZINE.

WITH THE YACHTS "BLENCATHRA" AND "PRINCESSE ALICE" TO THE BARENTS AND GREENLAND SEAS.

By William S. Bruce.

(*Read before the Society in Edinburgh on January 18th.*)

It is through the kindness of His Serene Highness the Prince of Monaco, and of Mr. Andrew Coats, that I am here to address you this evening.

On their respective yachts I had the good fortune last year to cruise over a great portion of the Barents and Greenland seas, and to make a number of scientific observations. It is a general outline of this work which I am about to give you.

I shall divide my paper into three parts. The first will be an account of the first voyage with Mr. Coats, in his yacht *Blencathra*, to the island of Kolguev and the coast of Novaya Zemlya. The second will be an account of Mr. Coats' second voyage to Bear Island, Hope Island, across the Barents Sea almost to the north end of Novaya Zemlya, and to the Wiche Islands. The third will be an account of my experiences on board the Prince of Monaco's yacht the *Princesse Alice*, in which we visited Bear Island, Hope Island, several parts of Spitzbergen, and the Greenland Sea.

On the 1st of May 1898 Mr. Coats set sail from Row, Gareloch, on his first Arctic cruise. As the deep-sea sounding machine had not arrived, I did not sail with the yacht, but waited for a week, taking the mail steamer from Newcastle to Bergen, and after a slow, but enjoyable, trip through the Norwegian fiords, where we called at over sixty places, I met the *Blencathra* on 19th May at Tromsö. There were on board Messrs. Andrew Coats, James Glen, Andrew Arthur, Hugh Parry, Dr. Cockburn, and myself. Two days before I arrived, the Tromsö neighbourhood was white with a fresh fall of snow. On the 21st we left Tromsö

for the north, calling at Hammerfest and Haaningsvaag, from which latter place—according to Dr. Sneider, of Tromsö Museum—I have been the first to collect a number of coleoptera. Aker fiord was next visited, in order to see a typical example of the wonderful bird-bergs of Norway, so vividly described by Brehm, Faber, and others. Kittiwake gulls, herring gulls, puffins, common guillemots, and razor-bills were there to be seen in thousands, reminding me of the still more remarkable cliff at Cape Flora, Franz Josef Land, where myriads of kittiwakes, Bruennich's guillemots, little auks, and dovekies resided during the summer months. Thereafter we steered for Novaya Zemlya, and on 30th May, at 8 P.M., we saw the ice blink. At eleven o'clock we sighted the first ice, and in half an hour the vessel came up to it. At midnight we were steaming through loose "brash" ice. The temperature of the air was 29·1° F., that of the surface of the sea 31·1°. There was a slight breeze from the eastward, and the typically overcast sky of the Barents Sea. Our course was E. ½ N. during that night, and we continued to work through a considerable amount of ice. At 10 A.M. on 31st May we sounded in 100 fathoms: no bottom

Up to this date, and for some days after, I was busy getting everything in order for observations of various kinds. On previous voyages I found the type of book used for taking observations, which is supplied by the British Meteorological Office, cumbersome and not well fitted for ship work. I therefore resolved to try a form of slips modelled after those which are used by the Scottish Meteorological Society at Ben Nevis Observatory, with alterations necessary for observations taken on board ship instead of on *terra firma*. These I found to be entirely satisfactory. Throughout the voyage I took four-hourly meteorological and general observations, the first mate usually assisting me with those at 4 and 8 A.M. The same day also I took my first surface tow-netting. I dragged the net from 6.30 till 7.30 P.M., and procured a green, slimy mass composed of diatoms and nauplii, besides other material. So as to be able to use the tow-net at all times without fear of collecting material thrown overboard, Mr. Coats had a boom rigged out for me from the fore-rigging, from the end of which the net dragged about midships, away from the ship's side.

Among other birds we saw ivory gulls.[1] Surely these interesting birds must have some breeding-place nearer than Cape Mary Harmsworth or Wiche Islands. I shall not be surprised if they are found to breed in Novaya Zemlya or Kolguev, or both. Besides the ivory gulls other birds were noted, and some seals. At midnight I threw over the first of a series of floats to indicate the direction and rate of currents. During 1896 and 1897 I also threw over a number of floats in the Barents Sea; none of these has yet been recovered. Soon after noon, on the 1st of June, the captain reported seeing the coast of Novaya Zemlya from the masthead, viz., Razor Cape, 45 miles E. ½ N. But the

[1] This was in latitude 70° N. Captain Rüdiger says they are hardly ever met with south of latitude 75° N. Vide *Verhandlungen der Gesellschaft für Erdkunde zu Berlin*, Band xxv., 1898, No. 8 u. 9, p. 441.

ice was very tightly packed between us and the land. We had therefore to turn the ship's head southward along the edge of this tight ice, working our way in a zig-zag course among outer, looser pieces. At 11 P.M. we passed a walrus sloop which, like ourselves, was trying its best to get in to the land. A gale sprang up in the night, which helped to break up the ice, and next morning we had a visit from the captain of the walrus sloop. He told us he had been out twelve days from Tromsö, that he had reached latitude 77° N. (which must have been much farther to the westward), and had on board six bears, six seals, and a walrus. At 10 A.M. next day we were 35 miles off the land, and at 6 P.M. 42 miles off in the vicinity of North Goose Cape. Many birds were passing in flocks going in a north-easterly direction.

By the 3rd of June the Lucas deep-sea sounding machine was rigged up with its 2500 fathoms of wire, and at 8 P.M. we took our first sounding with it in 75 fathoms. Afterwards we had the trawl over for the first time. It was a small double-headed trawl, modelled after that used by the United States ship *Blake*. The catch was rich, including cœlenterates, echinoderms, crustacea, molluscs, fishes. No chance offering itself to get in to the land during the next few days, we then steered for Kolguev, and sighted it at 9.30 A.M. On June 7th we lay-to six miles off the land, which was stretching between SSE. and WSW.; the lead touched bottom in 20 fathoms on sand; there was a heavy swell running from the westward. There was no tight ice here, only a few loose pieces, with a great number of very fine walruses lying upon them. There were none of the "endless fields of pack-ice" which Colonel Feilden[1] described for 1897, as late as on 5th of July, extending from Kolguev to Novaya Zemlya, nor was there any ice "resting on the north end of Kolguev." The whole coast of Kolguev was free of ice except these few loose pieces on the north coast which I have already described. Here the sportsmen obtained a few walrus, and I was able to make a number of biological and physical observations. All day long we saw plenty of ivory gulls, and this may be regarded as the first record of ivory gull for Kolguev; indeed I have little doubt that they will be found breeding there. On the 8th, 9th and 10th we had bad weather, and lay-to before a strong gale from the NNW.; the ship rolled very heavily, and I was in great distress, for, in spite of carefully stowing all my gear, it had got adrift in the forecabin, and spirit, formalin, and all kinds of precious things were all mixed up together. This gale drove us far to the SSE., and it was not till noon on the 10th that we sighted the land. At midnight on the 10th we anchored in five fathoms, about three miles off the land, near the river Baroskikka, in the south-east of the island. The gale had now blown what little ice there was away altogether, only leaving a few stranded pieces. I lowered away my traps here as on several previous occasions, but caught nothing. This was undoubtedly due to their framework being made of iron instead of wood.[2] On June the 12th we

[1] *Geographical Journal*, vol. xi. pp. 335 and 336.

[2] In Franz Josef Land, in 1896 and 1897, I made some traps with wooden frames, and met with success. The Prince of Monaco has since told me that he has had similar failure with metal-framed traps.

landed, but in rather an unfortunate place. Before us lay a long stretch of four or five miles of wet sand and lanes of water, with great masses of stranded pack-ice. We could not have got across this and back again in anything like reasonable time, and we were not prepared to wait here, it might be, for several days. So we wandered about the wet sand and over the stranded ice for some hours. Several birds were shot, and Mr. Parry found a glaucous gull's nest with two eggs. There were several other glaucous gulls' nests on the sand, where it was raised slightly above the rest. I remained mostly at the sea edge, and obtained a number of entomostraca, molluscs, and other things of zoological interest. Mr. Coats now resolved to land on the north or west coast of the island, but again the wind freshened after we got round, and prevented us effecting another landing. Eventually landing had to be abandoned, and having circumnavigated the island, we steered a course for Novaya Zemlya.

We passed through some drift-ice in the early morning of the 16th, but at 3.30 P.M. the coast of Novaya Zemlya was sighted, with no ice in view. We steamed north-westward along the coast, never seeing a piece of ice, and at midnight had a fine haul with the trawl. How different from the fields of ice which blocked our way just ten days ago! We went a little to the north of South Goose Cape, and then the ice stopped us once more; it was stretching right across our bows in a solid mass in an east and west direction, so we turned and anchored at the south end of Kostin Shar, off Kostin Point, in ten fathoms. On June the 19th we landed at Kostin Point. Here there are two Russian crosses, about 10 or 12 feet high. Perhaps what was of greatest interest was obtaining the grey phalarope (*Phalaropus fulicarius*), Mr. Reid and I each shooting one. This is a new record in the avifauna of Novaya Zemlya. Among other birds little stints (*Tringa minuta*), which Mr. Pearson and Colonel Feilden first found the eggs of in 1897, were numerous, and we saw many of their nests,[1] but it was too early for their eggs. A solid floe was stretching across the Shar to the mainland. On June the 20th there was a fresh breeze blowing, and a heavy fall of snow lay upon the decks. Next day, Midsummer day, however, it was fine, calm, sunny weather, and everybody went ashore at Cape Cherni, on the mainland, and good collections of plants, animals, and fossils were made. Here we met two Russians from the Pechora district; they had been wintering, and looked wretched specimens of humanity. More coal, fresh water, and provisions were now required, so we steered for Vardö. The breeze freshened, and on the morning of June 25th we ran into Vardö harbour before a strong gale of wind from the north.

We remained in Vardö for a week, and during this time visited the mainland, as well as the neighbouring islands of Hornö and Renö, which are noted as breeding-places of the eider-duck. These birds nest there in thousands, and one almost steps on the birds before they will reveal themselves by flying away. In addition to eider-ducks, there are a great number of glaucous and black-backed gulls, besides hosts of

[1] Vide *The Ibis* (Seventh Series), vol. iv. No. 14.—"Notes on Birds observed on Waigats, Novaya Zemlya, and Dolgoi Island in 1897. By Henry J. Pearson."

THE YACHT "BLENCATHRA" IN THE ICE OF BARENTS SEA.

CAPE CHERNI, NOVAYA ZEMLYA, LAT. 70° 50' N., LONG. 53° 26' E.

SW. COAST OF KOLGUEV, NEAR RIVER BAROSKIKKA.

THE WHOLE WEST COAST OF HOPE ISLAND, LENGTH ABOUT 13 MILES.
HEIGHT OVER 1000 FEET.

kittiwakes on the more precipitous rocks. There are puffins, razor-bills, cormorants, and black and common guillemots as well. The herbage is remarkably rich, *Cornus suecica*, a pink lychnis, scurvy grass, and ferns being the most conspicuous.

At length, on the 1st of July, we set sail once more for the ice. Our course lay in a more or less north-westerly direction towards Bear Island. Nordkyn, some fifty miles from Vardö, was abreast of us at six o'clock next morning, and at five o'clock on the afternoon of the 3rd we sighted Mount Misery, the highest hill in Bear Island, bearing W. by N. from the *Blencathra*. We steamed round the north side of the island, and just before midnight dropped anchor in 14 fathoms on the west side. We lay there for the night, Mr. Coats intending to land the following day; Captain M'Kay, however, not finding the anchorage very suitable, moved round to the south, but as he found nothing in the way of a harbour, and feared a breeze, landing had to be abandoned; so after circumnavigating the island, we turned our course to the more interesting and less known Hope Island. On the homeward voyage of the *Windward* with the Jackson-Harmsworth expedition, we intended to land at Bear Island, and failed on account of the head winds: thus for the second time I was disappointed within twelve months. We had now gone 47 miles to the north-eastward, when we were signalled to by a very small Norwegian steamer. Mr. Coats told the captain to head towards her. She wanted to know her position; for more than a week she had been continually in fog—a not unknown feature of the Barents Sea—and had quite lost her reckoning. We were soon able to give her the information she required, and each vessel went on its course, she to the southward, and we towards Hope Island. While yet as far as 44 miles from Hope Island we sighted the land. Ice was now reported from the mast-head, but it turned out to be a false alarm. At 4.30 P.M. we took a sounding in only 38 fathoms, with a bottom of small stones, on the bank that stretches the whole way between Bear Island and Hope Island, and which in some places is only 20 fathoms below the surface. Gradually we approached the island, and both Mr. Coats and myself had the good fortune to get very fair photographs of the south end. As the Admiralty chart only gives a dotted outline for its coast, and does not indicate its elevation, I shall later on spend a minute or two in describing it. Suffice it to say just now that we steered round to the west side, where I got other two photographs of its entire west coast. Captain M'Kay dropped anchor six miles off in 15 fathoms. By eleven o'clock Mr. Coats ordered the steam launch to be lowered, and with the small Norwegian seal-hunting boat we steamed for the shore. There was a heavy swell running at the time, but the boat was let go from the launch, and Mr. Reid, myself, and two Norwegian sailors pulled fairly close in, when our keel bumped on the bottom, but next minute we could not touch bottom with the oar. After spending nearly an hour we had to abandon the attempt, as landing meant certain immersion in the ice-cold water and probable upsetting of the boat, with guns, ammunition, etc., and as well as the probability of having to stay on shore for some days without provisions

or dry clothing. There was nothing else to be done but to turn back again once more to the ship. Next day, before steering to the north-eastward, we had another haul of the trawl in 27 fathoms. Unfortunately the tail of the net fouled over the mouth of the trawl, and we got very little, although, from the amount and variety that did come up, I could see that the bottom was very rich in animal life. This was proved later on by one of the richest hauls the Prince of Monaco obtained close by.

We then headed NE. by E., and for the first time saw Spitzbergen, viz., Edge Land, and, at the same time, Hope Island on the other side. We were steering a course towards the Wiche[1] Islands, and as no soundings had been taken here, I suggested to Mr. Coats that we should sound every two hours. Mr. Coats quite fell in with the idea, and I took soundings till 4 A.M., when we were finally stopped by impenetrable ice. The deepest of these soundings was 98 fathoms in clayey mud at 2 A.M. These and other soundings which I took, when they are in localities where no soundings have hitherto been made, are to be found in the table.[2]

To reach Wiche Islands just then, even with a much stronger ship than the *Blencathra*, was impossible, so Mr. Coats cruised away to the eastward along the tight pack-edge, in among the looser navigable outside ice, going into all the bights that seemed like openings towards Franz Josef Land and the north, and did the extremely useful piece of work of mapping out the line of the pack-edge for July 1898 from Spitzbergen almost to Novaya Zemlya. This line runs in a more or less WNW. and ESE. direction from 77° 37′ N., 28° 48′ E., to 75° 46′ N., 50° 32′ E., and has a deep bight, attaining latitude 77° 36′ N. in 40° 15′ E. We were enveloped for the whole time in the very thickest fog or mist, and had to make our course by dead reckoning, but the course, as I charted it, is very approximately correct, and may be taken as the line of ice for July 1898. During this cruise right across the Barents Sea the trawl, dredge, tangle, and tow-net were continually at work, and some valuable additions were made to our knowledge of the fauna of the Barents Sea. We also took several soundings, and I was able to take a few deep-sea temperatures and salinities when the vessel was absolutely at rest. The deepest water here was 110 fathoms, which is an average depth for the whole of the Barents Sea. On July 15th we were back again to the southward of the Wiche Islands, and this time sighted the Swedish Foreland at noon, bearing NE. ¾ N. to N. ¼ E. That day we fell in with two bears, a male and a female, and naturally there was a good deal of interest for those who were to have their first shot at this large North Polar mammal. Both bears were dropped. During the second hunt Dr. Cockburn and myself were in the crow's-nest. The hunt was on a large floe. The bear, which first charged towards the boat, was wounded, after which it took to its heels, as they nearly always do, and rapidly gained on its pursuers, now in full chase after it on the ice-floe. But a long shot

[1] I call these islands by the name given to them by their discoverer, the British voyager Edge, in 1617, and not by that given them after the voyage of von Heuglin and Graf Zeil in 1870, viz., King Charles Islands, in honour of the King of Würtemberg.

[2] *Vide* pp. 125-6.

dropped it, and in double quick time the doctor and the naturalist were seen slipping down the fore-rigging to get at their cameras, tape measures, and dissecting knives. After having taken all the measurements, and having photographed the victim a dozen times, the Norwegian walrus-hunters were shown how to make cuts for removing the skin, and Dr. Cockburn and myself roughly studied its anatomy. Both skins were of a fair size and in good condition.

We were again in the neighbourhood of the Wiche Islands, and I must spend a little time describing these interesting and little-known islands.

In 1897 the Admiralty chart marked five islands from east to west, viz., Swedish Foreland, Jena Island, Abel Island, adding the two very large Johannesen Islands. On the homeward voyage of the *Windward* we passed within three miles to the south-eastward of the easternmost of these two Johannesen islands, and from the masthead in clear weather saw no sign of them. Last year also the Scottish whaler *Balæna*, on her return from Franz Josef Land, where she had been walrus-hunting, sailed over their assigned position, and Mr. Pike, in his yacht, the *Victoria*, saw no signs of them whilst cruising in their vicinity. The Admiralty, therefore, last year left them out.[1] The first island we saw was Swedish Foreland, and I was fortunate enough to get a photograph of it, showing Cape Hammerfest. To the east of this we saw Jena Island, Cape Altman standing out prominently: this land tailed away into low glaciated land to the eastward. Beyond this, bearing NE. ½ E., was what appeared to be a third island, towards which we steamed, and as the land opened up we could see more of Jena Island. At the back of the glacier stood a very prominent bell-like crag, which is faintly indicated in a photograph I have taken, and quite clearly shown in the sketch I made on the spot. Perhaps this is what Captain Rüdiger afterwards saw and named Enemy mountain. We then got to the ESE. of what appeared to be a third island, but which I find, on comparing my sketches with that of Mr. Arnold Pike,[2] must be the east end of Jena Island, the low land forming the curve of Victoria Bay not being seen by us. To Dr. Kükenthal in 1889 Jena Island appeared as two islands, and Captain Rüdiger, of the German ship *Helgoland*, who visited these islands after we did last year, says that the low-lying land may easily be mistaken for a channel. In front, and extending beyond the bluff cliff and talus of Cape Altman, stretched a low spit of land, clearly indicated in the sketch: this was probably the low islands which are in Victoria Bay.

Mr. Pike[3] thinks that the mapping of the two Johannesen Islands probably arose from the shape of Jena Island. He says, "I feel con-

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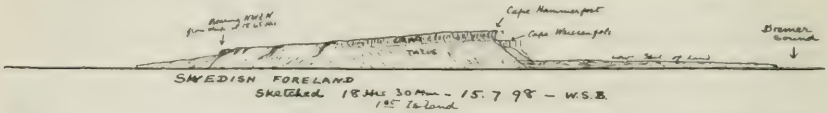
[1] Vide *Geog. Journal*, vol. xi. No. 4 (Routes of the *Victoria*, *Balæna*, and *Windward*). The *Blencathra* also sailed over the West Johannesen Island last year. It was therefore scarcely the *Helgoland* that "completely established their non-existence." Vide *Verhandlungen der Gesellschaft für Erdkunde zu Berlin*, Band xxv., 1898, No. 8 u. 9.

[2] Vide *Geog. Journal*, vol. xi. No. 4, p. 369. Captain Rüdiger also gives this as his opinion. Vide *Verhandlungen der Gesellschaft für Erdkunde zu Berlin*, Band xxv., 1898, No. 8 u. 9, p. 442.

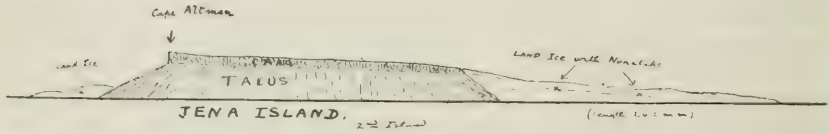
[3] *Geog. Journal*, vol. xi. No. 4, p. 366.

vinced that the mistake arose through the shape of Kong Karl's Land (Jena Island) itself, which, when viewed from a short distance, appears as two, or from some points of view as three, islands." Beyond this last named, Captain M'Kay, Dr. Cockburn and myself, who were all at the masthead, saw lying away to the north-eastward a very low flat island which could not be photographed, and which could not be seen from the

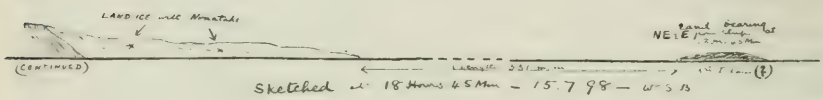
(1)



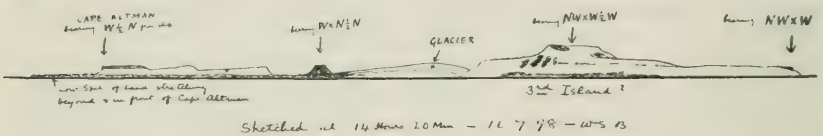
(2)



(3)



(4)



SKETCHES OF WICHE ISLANDS, JULY 1898, by WILLIAM S. BRUCE.

Note.—(1), (2), and (3) must be looked upon as continuous; (1) being the west end of the land, and (3) being the east end of the land as seen between 18 hrs. 30 min. and 18 hrs. 45 min., on July 15th, 1898. The whole is drawn to scale; thus, the length from end to end of the land in (2) Jena Island is 242 units, and the length indicated thus ←→ in (3) should be 331 units, being contracted only to get the apparent third island into the same sketch.

No. (4) is an enlarged view of the apparent third island, with a view of Cape Altman and the rest of Jena Island farther away and to the westward (*i.e.* left half of the sketch). I sketched this on July 16th, 1898, at 14 hrs. 20 min., when the ship was in a more easterly position, Cape Altman lying almost due west of us. Thus the summit of the apparent third island bore NW. by W. ½ W., instead of NE. ½ E. as on the previous day. The result of this change of position is a modification of the appearance of the east end of Cape Altman; a view of the bell-shaped rock bearing W. by N. ½ N. which was not seen on 15th July; and an enlarged view of the land which looked like a third island.

deck. But from the masthead it was seen perfectly clearly. This was on the night of the 16th in clear weather and bright sunshine. On the 17th at noon I took a sextant observation, but there was so much refraction that the horizon was not reliable in spite of very clear weather. Unfortunately the wind now increased from the eastward, and the ice was coming in, packing against the east of Spitzbergen. We had therefore to retreat, and as it was had considerable difficulty in extri-

cating the *Blencathra* from the ice. Afterwards the weather became very bad with wind and fog, and it was necessary for Mr. Coats to return home. A week later the German ship *Helgoland*, under the command of Captain Rüdiger, who had failed to get anywhere near these islands earlier in the season on account of the ice, now found little ice where we were hemmed in and had difficulty to extricate the yacht *Blencathra*. What a difference may take place in a few days! Mr. Pearson and Colonel Feilden had a similar experience at Novaya Zemlya the year before. He says, "Rounding the north end of Kolguev Island we found that a marvellous change had taken place during the past ten days. The endless fields of pack-ice which before extended from Kolguev to Novaya Zemlya had entirely disappeared. Now and again we passed a sodden, dirty fragment of ice rapidly melting; the fog had gone, and in bright sunlight and with a favouring wind we made the northern entrance of the Kostin Shar on the evening of July 17th." [1] I have already narrated the similar experience Mr. Coats' yacht had off Novaya Zemlya earlier in the season last year. Captain Rüdiger coming later had the good fortune to get right into the land and effect a landing on the low unnamed island which we had previously seen from the masthead, and which Mr. Arnold Pike discovered and described in 1897.[2] Captain Rüdiger alters the position of south and Swedish Foreland and Jena Island, placing them farther north, and making the islands much smaller. But Mr. Pike sailed in and out and all round these islands, and his observations taken on shore with sextant and artificial horizon, both on Cape Weissenfels and near Tömmernæs, agreed *very nearly* with his position on the Admiralty Chart. Mr. Pike was also on Cape Hammerfest, and "climbed about 500 feet up the hill at the east end of König Karl" (Jena Island). On the low unnamed island Captain Rüdiger discovered ivory gulls breeding, and claims that he has discovered the first known breeding-place of the ivory gull. He appears to have overlooked the fact that Mr. Pike found them breeding on Cape Weissenfels in 1897, and that we, with the Jackson-Harmsworth Polar Expedition, discovered tens of thousands breeding at Cape Mary Harmsworth, and brought home eggs and birds. Mr. Leigh Smith in Franz Josef Land and others have also found ivory gulls breeding.[3] After this an attempt to go up Stor fiord had to be abandoned on account of bad weather, and the second voyage of the *Blencathra* ended on the 25th of July by dropping anchor in Tromsö.

I have given an account of Mr. Coats' voyage to this Society rather from a purely geographical point of view than otherwise, but the chief scientific work done was zoology. We trawled, dredged, trapped, in order to capture animals from the bottom, and tow-netted to capture the floating plankton, and thus obtained a goodly number of animals, which I am at present working at with the help of specialists at home

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[1] *Geog. Journal*, vol. xi. No. 4. p. 338. [2] *Ibid.* p. 336.

[3] *Ibis* (Seventeenth Series), vol. iv. No. 14, pp. 264-267.—"On the avifauna of Franz Josef Land, by Wm. Eagle Clarke, F.L.S. With notes by Wm. S. Bruce, of the Jackson-Harmsworth Expedition."

Richardson and M'Clintock first found ivory gulls breeding during the Franklin Search Expeditions; Malmgren found them in 1861 in Spitzbergen; Feilden in Smith's Sound in 1875.

and abroad. These, along with the animals I captured in and near Franz Josef, and on my voyages out there in 1896 and back again in 1897, will, I venture to predict, form a very considerable addition to our knowledge of the fauna of the Barents Sea, of which we have only scanty records. In addition to zoological work we took a number of soundings, ascertained the temperature and salinity of the water at different depths, threw out floats to ascertain the direction and rate of currents, and took continuous meteorological observations. Whenever a landing was effected, not only animals, but also plants, rocks, fossils, and anything else of interest, were collected. The following is the record of observations and collections made at 249 stations :—

34 Hawls with the dredge, trawl, tangle, and trap.
60 Gatherings of surface plankton.
88 Soundings, 57 being in new localities.
30 Salinity observations.
147 Floats thrown out at thirty-seven stations.

But the arrival of the *Blencathra* in Tromsö did not after all terminate my voyages to the Arctic last year. The Prince of Monaco's new yacht, *Princesse Alice*, had arrived there only just before we did, from the south. He was about to prosecute his oceanic researches in a different direction this season, viz., in the Arctic seas round about Spitzbergen, instead, as in past years, in the Atlantic and Mediterranean. It was a pleasant surprise to me to be asked by His Highness whether I would not return with him to Spitzbergen now that the cruises of the *Blencathra* were over. I could not refuse so tempting an offer, and on the 29th of July I was voyaging once more to the north. It is not my purpose to give you a detailed account of the "Voyage of the *Princesse Alice*." The Prince will do so personally before the Academy of Sciences in Paris and elsewhere, and it would be impertinent on my part to anticipate him. I may, however, perhaps be permitted to give a few personal reminiscences of a most pleasant and profitable voyage.

There were on board besides the Prince, Captain Carr, Professor Brandt of Kiel, Mr. J. Y. Buchanan, Dr. Jules Richard, chief of the Prince's scientific staff, four others, and myself. From Tromsö we steered for Bear Island, and arrived there on the morning of July 30th, anchoring in 10 fathoms off the south-east of the island, at the foot of Mount Misery. This time a landing was successfully accomplished.

Once ashore we all went in different directions, and came home by the end of the day pretty heavily laden. I climbed up Mount Misery to a height of 600 feet, and did not go farther because of a thick cloud which enveloped the other 600 feet, in which I should have been able to see nothing. At this height, however, I came across a "bird-berg" swarming with kittiwake gulls, fulmar petrels, puffins, and guillemots. Most of the eggs were hatched, and some of the young birds were beginning to fly. I got a number of fossils also *in situ* at this point. Bear Island is a desolate, wind-swept island, but in the interior are a number of fresh-water ponds which would, no doubt, be interesting to the zoologist. In the evening we left for Hope Island, which we came upon in a thick fog; but such a good course had been steered that we

NORTH SHORE OF CHANGING POINT, BARENTS ISLAND,
GINEVRA BAY.

MOUNT TEMPLE, SASSEN BAY, SPITZBERGEN.
(RAISED BEACHES IN FOREGROUND.)

GRAND (OR POST) GLACIER, SASSEN BAY, SPITZBERGEN.

FACE OF GRAND (OR POST) GLACIER, SASSEN BAY.

headed straight for the south end, and anchored half a mile or less from it, under the precipitous cliff of about 1000 feet. Next morning the *Princesse Alice* went round to the east side, anchoring about a mile from the shore, and we landed exactly opposite the place where we had attempted to land with Mr. Coats; this time it was quite calm, and there was no swell. Hope Island is described in the Admiralty chart as "*quite barren.*" But even without landing it was obvious that this was not correct, for from the *Blencathra* boat I could see plants growing, and it was quite obvious that Richardson's skua was breeding there, and that it was a resort for other birds. We recorded on the *Blencathra* Richardson's skua (probably breeding), glaucous gulls, rotges, looms (probably common and certainly Bruennich), dovekies, great numbers of kittiwakes, and puffins. The whole party dividing up, I, attended by a seaman, climbed to the summit in order to ascertain the height and structure of the island as far as it was possible. With some difficulty we managed to climb to the top, which, ending in a rotten, shaley cliff of about 20 or 30 feet, crumbled away as we tried to climb up it. We were now at an elevation of 870 feet. The island is table-topped and cut up with gullies. At 730 feet I deposited a record in a cairn which we built. The highest part that I reached was 920 feet, farther westward. I should say that the south end is slightly higher, having an altitude of about 1000 feet, that being the highest part of the island. On my way up I found a certain number of fossils; these bear some resemblance to those of the Carboniferous period, but as they have not yet been examined by specialists, it is hazardous to express an opinion. On my trip I saw rotges breeding, and almost certainly the pomatorhine skua. I fired at one, but only knocked some feathers out of his wing and did not get another shot at him. I also saw Arctic skuas, many ducklings, mollies, and kitties, and shot a black guillemot. On the summit I found flies, snow fleas, a worm, green algæ, and other plants, and lower down more plants, which my friend, Mr. Robert Turnbull, has examined. It was a great satisfaction to get these animals and plants, and the Admiralty must now erase "quite barren" from their charts. There were many whale's bones, and much driftwood on the shore; one trunk I measured was 60 feet long. There are raised beaches to at least 80 or 100 feet, and miniature glaciers in the higher gullies.

Thereafter we steered about 40 miles to the north-eastward; but, meeting with ice, we could no longer proceed to the northward, the *Princesse Alice* being a steel vessel, so a course was steered for South Cape. Thence we went up Stor fiord to Ginevra Bay, where we made excursions by land and in the steam launch. Reaching as far as Helis Strait, we had an exciting incident in getting into a fully eight-knot current; but, thanks to the Prince's skilful handling of the launch, we were none of us the worse for it. After some days we went south again down Stor Fiord, and there is certainly no low flat island midway, as marked in the Admiralty chart of Spitzbergen. Thereafter we did some trawling to the westward of South Cape in deeper water than I had seen trawling or dredging. The catches were all of extreme interest, but I will not anticipate His Highness in giving you

details about them. We visited after this Sassen Bay, Advent Bay, Klaas Billen Bay, Smeerenberg Sound, Amsterdam and Dane's Island. On Dane's Island we saw Pike's house intact, and Andrée's balloon-house in ruins. Steering to the northward of Smeerenberg Sound, we reached latitude 80·34° N., and this was the Prince of Monaco's highest northern station. We could get no farther for ice, but I think it is just about a record high latitude for a steel vessel. The chief work of the voyage, of course, was deep-sea work. The deepest dredging was made on the 4th of September, in about 1800 fathoms, or more than two miles below the surface. Professor Brandt and Mr. J. Y. Buchanan left the yacht at Advent Bay, as it was getting late and they had to return. Thereafter the Prince intrusted me with making the observations for salinity, and with the working of the Hensen quantitative plankton net. I was very glad to have such an opportunity afforded me.

I wish to take this opportunity of expressing my gratitude to His Serene Highness the Prince of Monaco for the not only delightful, but also very profitable, time I had on board his magnificent yacht. Such an opportunity does not fall to the lot of every naturalist, and I feel quite unable to express adequately my sincere thanks.

Not less are my thanks due to Mr. Andrew Coats for his great kindness in enabling me to carry on further researches in the Arctic. When Mr. Coats asked me to join him he told me he was going for sport, that he wanted to shoot some bears and walruses, and that I must not regard the cruise as a scientific expedition. Mr. Coats has had excellent sport, but all will agree that he has also done excellent scientific work. It is to British yachtsmen such as these, whether they take a direct or indirect part in the work, that we owe much of our finest Arctic work, and I am sure you will all join with me in expressing the hope that Mr. Coats will spend more than one other season in the Arctic, and thus add to the lustre of Britain in the Polar Seas.

At the conclusion of the lecture Mr. R. Turnbull, B.Sc., made the following remarks on the

Flora of Hope Island.

The plants collected by Mr. W. S. Bruce were given me for identification, and the collection is the first recorded from that island, but, unfortunately, it is far from complete, because of the limited time Mr. Bruce spent on the island.

The vegetation of the part of the island passed over was scanty, and even the lichens—luxurious elsewhere in the Arctic—were very much dwarfed. From the *Princesse Alice* at the SE. corner of the island, a portion of flat land appeared at a distance as green as a meadow, but there was no time to visit this comparatively rich area. A sample of soil and water from near the summit showed the Red-Snow Alga (*Sphaerella nivalis*), a species of Merismopedia (one of the Schizophyceæ), Desmids (Cosmarium and Calocylindrus types), several Diatoms, and a Zygnema (one of the Conjugatæ). From the rocks and soil generally were obtained four lichens, *Cetraria islandica*, L. (Icelandic moss); *Platysma nivalis*, L.; *Stereocaulon*

paschale, Ach.; and *Sphaerophoron coralloides*, Pers.; several mosses, but none in the capsule stage; and eight flowering plants, viz., a grass in flower (*Phippsia algida*, R.Br.), Iceland poppy in flower (*Papaver nudicaule*, L.), *Saxifraga oppositifolia*, L., in flower; *S. cernua*, L., in flower; *S. caespitosa*, L., in flower; *S. Hirculus*, L., not in flower; *S. hieracifolia*, Waldst. et Kit., in fruit; and *Stellaria humifusa*, Rottb., not in flower.

I am indebted to Colonel H. W. Feilden for help in naming the flowering plants from his large Arctic collection, and also for pointing out that *P. nudicaule* and *S. oppositifolia* are universally distributed throughout the Arctic, and that along with *Cerastium alpinum* and *Dryas octopetala* var. *integrifolia* they share the position of growing in the most northern land yet reached by man, having been obtained at Lockwood Island, 83° 24′ N., by Lieut. Lockwood, of the Greely Expedition.

TABLE I.—Soundings taken during the first cruise of steam-yacht *Blencathra*. in new localities, May and June 1898, in south-east of Barents Sea.

No. of Station.	1898. Date.	Hour.	Position. Latitude.	Longitude.	Depth in Fathoms.	Nature of Bottom.	Notes.
1	May 30	15 h. 15 m.	73° 18′ N.	43° 32′ E.	100	No bottom.	Hand lead.
2	,, 31	10 h. 0 m.	73° 03′	47° 45′	100	No bottom.	Hand lead.
3	June 2	1 h. 0 m.	72° 32′	50° 00′	50	No bottom.	Mill's deep-sea water bottle.
4	,, 2	6 h. 30 m.	72° 24′	50° 02′	56	Sand and mud.	Ordinary reel with wire and Kelvin depth recorder.
6	,, 3	7 h. 15 m.	71° 36′	49° 12′	65	Mud.	Do.
7	,, 3	18 h. 0 m.	71° 21′	48° 40′	75		Lucas, deep-sea sounding machine.
9	,, 6	16 h. 0 m.	70° 10′	49° 08′	34		Do.
10	,, 6	20 h. 0 m.	70° 03′	49° 10′	25		Do.
11	,, 7	9 h. 30 m.	69° 30′	49° 21′	20	Sand.	Do., Kolguev bearing SSE. and WSW. six miles.
16	,, 10	9 h. 0 m.	69° 10′	50° 26′	22	Green mud and sand.	Hand lead.
38	,, 15	13 h. 0 m.	69° 05′	51° 45′	27	Grey clay.	Lucas machine.
39	,, 15	14 h. 0 m.	69° 08′	51° 53′	28	Rock.	Do.
40	,, 15	16 h. 0 m.	69° 15′	52° 16′	30	Rock and mud.	Do.
41	,, 15	20 h. 0 m.	69° 28′	52° 57′	27		Do.
42	,, 15	Midnight.	69° 44′	53° 40′	38	Rock.	Do.
43	,, 16	2 h. 0 m.	69° 52′	54° 00′	40	Mud and shells.	Do.
44	,, 16	4 h. 0 m.	69° 57′	54° 15′	41	Mud.	Do.
45	,, 16	6 h. 0 m.	70° 05′	54° 40′	41	Mud.	Do.
46	,, 16	8 h. 0 m.	70° 12′	55° 00′	38	Mud.	Do.
47	,, 16	10 h. 0 m.	70° 18′	55° 21′	60	Rock.	Do.
48	,, 16	Noon.	70° 23′	55° 33′	65	Rock.	Do., twelve miles SSE., off Chernoi Nos.
49	,, 16	14 h. 0 m.	70° 28′	55° 08′	75	Rock.	Do., eight miles SW., off Chernoi Nos.
50	,, 16	16 h. 0 m.	70° 34′	54° 38′	78	Mud and shells.	Lucas machine.
51	,, 16	18 h. 0 m.	70° 39′	54° 09′	31	Green sandy clay.	Do.
52	,, 16	20 h. 0 m.	70° 44′	53° 41′	27	Rock.	Do.
53	,, 16	Midnight.	70° 51′	53° 00′	16	Rock.	Do., four miles S., off Kostin Point.

TABLE II.—Soundings taken during the second cruise of the steam-yacht *Blencathra*, in new localities, July 1898, in the west of the Barents Sea, and from west to east between latitudes 75° to 78° north.

No. of Station.	1898. Date.	Hour.	Position. Latitude.	Longitude.	Depth in Fathoms.	Nature of Bottom.	Notes.
56	July 2	17 h. 0 m.	72° 32′ N.	24° 22′ E.	150		Lucas. Wire carried away, lost sinker and thermometer.
57	,, 3	13 h. 0 m.	74° 02′	21° 00′	75	No bottom.	Lucas.
58	,, 3	17 h. 0 m.	74° 23′	20° 22′	40	Shell and coral.	Lucas. Mount Misery bearing W. by N.
59	,, 3	19 h. 0 m.	74° 40′	18° 57′	25	Shell and coral.	Lucas. 2½ N. of Bear Island
60	,, 3	23 h. 0 m.	74° 27′	18° 20′	14		Hand lead. West side of Bear Island. Let go anchor.
61	,, 5	16 h. 30 m.	76° 17′	24° 23′	38	Small stones.	Lucas.
62	,, 5	20 h. 0 m.	76° 43′	25° 17′	23	Stone w. coral.	Hand lead. Let go anchor 5 m. W. of Hope Island.
63	,, 6	13 h. 0 m.	76° 57′	24° 59′	27	Mud.	Hand lead.
64	,, 6	22 h. 0 m.	77° 17′	26° 40′	66	Mud.	Lucas.
65	,, 6	Midnight.	77° 24′	27° 19′	74	Clay.	Do.
66	,, 7	2 h. 0 m.	77° 32′	28° 03′	98	Muddy clay.	Do.
67	,, 7	4 h. 0 m.	77° 37′	28° 46′	80	Stiff grey clay.	Do.
68	,, 7	Midnight.	77° 03′	33° 00′	84	Mud.	Do.
69	,, 8	23 h. 30 m.	77° 14′	38° 26′	76	Mud.	Do.
70	,, 12	23 h. 0 m.	76° 01′	39° 04′	90	Mud.	Do.
71	,, 12	Midnight.	76° 03′	38° 41′	80	Clay.	Do.
72	,, 13	15 h. 0 m.	76° 24′	33° 43′	100	Mud.	Do.
73	,, 14	8 h. 0 m.	76° 44′	30° 30′	100	Mud.	Do.
74	,, 14	Noon.	76° 47′	29° 55′	100	Mud.	Do.
75	,, 15	7 h. 0 m.	77° 53′	27° 48′	100	Mud.	Do.
76	,, 19	10 h. 15 m.	77° 25′	25° 13′	35	Grey clay.	Do.
77	,, 19	14 h. 30 m.	77° 20′	24° 53′	38	Grey clay.	Do.
78	,, 20	10 h. 30 m.	76° 48′	21° 10′	Reef	Rock.	Sea breaking.
79	,, 20	20 h. 0 m.	76° 22′	21° 33′	100	Mud.	Lucas.
80	,, 20	22 h. 15 m.	76° 17′	21° 36′	60	Clay.	Do.
82	,, 21	14 h. 15 m.	75° 55′	21° 18′	27	Stones.	Do.
84	,, 21	16 h. 0 m.	76° 03′	20° 50′	27	Stones and sand	Do.
85	,, 21	Midnight.	76° 29′	19° 08′	140	Rock.	Do.
86	,, 22	8 h. 0 m.	76° 05′	19° 57′	72	Mud.	Do.
87	,, 22	Noon.	75° 52′	20° 22′	52	Mud.	Do.
88	,, 22	15 h. 30 m.	75° 34′	20° 31′	43	Sandy mud.	Do.

NATURAL RESOURCES OF THE BARREN LANDS OF CANADA.

By J. B. TYRRELL, M.A., B.Sc., F.G.S.

(*Read at the Meeting of the British Association, Toronto*, 1897.)

CANADA, including the Arctic Islands, has an area of nearly 3,500,000 square miles. At present only 10 per cent. of this area is under cultivation of any kind, and probably not more than 35 per cent. is capable of cultivation. Possibly 25 per cent. of the land is more or less densely covered with forest, but most of this lies within the area that is capable

of cultivation, and there remains to us a vast extent of territory, probably between a million and a half and two millions square miles in area, which will not grow any of the ordinary cereals or grasses, and on which there is no forest of any commercial value. As this country has been intrusted to our charge, we are bound by our duty to our fellow-men, and to the Supreme Ruler of the Universe, to study how we can make the most of the inheritance, so that it may add something to the sum of human comfort and happiness.

This vast northern wilderness is usually supposed to be the home of the fur-bearing animals of Canada, and to have little groups of houses, occupied by hardy and adventurous traders, scattered here and three over it. This conception will, however, apply to only a portion of the region. In the extreme northern portion of the Dominion there is an area of 730,000 square miles in which there are very few fur-bearing animals, no traders' houses, and which, except around the coast and along some of the larger streams, has rarely or never been visited by white men. This portion of the Dominion is known to the Indians of the adjoining forests as the "Bare or Treeless Lands," a name which has been translated into English as the "Barren Lands." Of it 300,000 square miles lie in the Arctic Islands, 50,000 square miles in the north-western corner of Labrador, and 400,000 square miles west of Hudson Bay. As far as can be determined at present, it is reserved for the geologist and the prospector to discover and point out the value of this country, for while some parts of it may be used as pasturage for herds of reindeer, and fish may be caught in considerable numbers in the lakes and streams, these industries will be secondary to the mining of gold, silver, copper, iron, coal, and other minerals, which in time miners will dig from beneath a surface that is too cold to produce a food-supply for any large number of people.

The portion of the Barren Lands to which I propose to draw your attention is the region lying west of Hudson Bay, with a greatest length from SE. to NW. of 1200 miles, a greatest breadth from SW. to NE. of 750 miles, and an area of 400,000 square miles, a region about twice as large as the province of Ontario, or more than three times as large as the whole United Kingdom.

It forms a roughly triangular area bounded on the north by the Arctic Ocean, on the east by the west coast of Hudson Bay and Fox Channel, and on the south-west by a line extending from the vicinity of Churchill on Hudson Bay, north-westward, roughly at right angles to the magnetic meridian, crossing the Kazan river at Ennadai lake, the Telzoa river at Boyd lake, passing south of Clinton-Colden and Aylmer lakes, across Point lake, and down the east side of the Coppermine river to within fifty miles of its mouth, and thence striking westward across the Anderson river till it reaches the Arctic coast near the mouth of the Mackenzie river. This line follows very closely the line of the mean summer temperature of 50° F., south of which some of the most hardy trees can grow and ripen their fruit, while north of it the summer is not sufficiently long, or warm, to allow even the most hardy trees to bring their fruit to perfection.

In general character the country is a vast undulating plain, underlain by a stony clay, and covered with short grass or deciduous Arctic plants. In certain sections no rising ground can be seen for miles around, and in other sections rocky hills rise through the general covering of clay. The whole land reminds one forcibly of the great plains of Western Canada, the chief points of difference being caused by the differences in the underlying rocky floor. The boulder-clay underlying the plains is deposited on a floor of soft Cretaceous shales and sandstones, and even where the soft rocks crop out at the surface they rarely form conspicuous hills; the boulder-clay underlying the Barren Lands is deposited largely on a floor of igneous, or hard, highly altered rocks, which, wherever they appear at the surface, form rocky knolls that stand up distinctly above the surrounding clay, while the boulder-clay itself, being formed out of material derived from the hard granitoid rocks, is much more stony than the clay of the more southern plains.

No part of the country rises to any great altitude above the sea, the highest point being probably the ridge of rocky hills called Stony mountains, which run along the east side of the Coppermine river, and are said to rise about 1500 feet above the sea. Ennadai lake lies 1100 feet above the sea, Doobaunt lies 500 feet, and Yath-kyed lake 300 feet.

The country may be conveniently divided into two distinct portions, namely, the Interior Upland and the Coasted Plain.

The Interior Upland includes all those parts of the country lying above the highest ancient shore-line, either of Hudson Bay or of the Arctic Ocean, and has a mean elevation of from 900 to 1000 feet above the sea. Its surface is composed largely of sandy boulder-clay, and rounded boulders or broken fragments of the underlying rock. Low ridges and rugged, irregular hills are common over the surface, while eskers, or long straight ridges of sand and gravel, extend in uninterrupted courses over hills and valleys alike. Here and there some ancient beaches mark the positions of small lakes which have long since disappeared.

The Coasted Plain lies between the highest ancient post-glacial sea-beach and the present sea-shore, sloping gradually from a height of 500 to 600 feet down to the sea-level. Much of this plain has a stony surface, like that of the Interior Upland, but it is diversified with sandy plains, and on all the steeper slopes gravel terraces or coast cliffs mark the lines of the old sea-shore. Many of the terraces fill narrow gaps between adjoining hills, and the lower ones are often strewn with shells such as are found in Hudson Bay at the present time. The waves have reduced the surface irregularities of this portion of the country to some extent, but the more rocky districts, such as those in the vicinity of Chesterfield Inlet are still, except for the presence of the little terraces, as rough and rugged as before they were covered by the sea, and the highest parts are probably barer, for any loose material that had been left on them by the ice-sheet of the glacial period has been washed by the waves into the depressions. The breadth of this plain in the vicinity of Churchill is about fifty miles. Farther north it becomes broader, until, in the latitude of Yath-kyed lake, it has a breadth of 125 miles, and at the north end of Doobaunt

lake extends westward for 300 miles. North of Doobaunt river its extent is not yet known, but many of the old sand plains and terraces reported from the banks of Back river probably mark old shore-lines on this Coasted Plain, there sloping northward toward the Arctic Ocean.

In a few places the coast-line is fairly high, but as a rule it is low, and slopes gently down into a shallow sea. The whole country has a fairly general slope north-eastward, and the three principal streams which drain it have a more or less parallel course in that direction, while other smaller streams flow more directly towards the coast, northward to the Arctic Ocean, and eastward to Hudson Bay. These three streams are the Thlew-e-cho, Great Fish or Back river, the Telzoa or Doobaunt river, and the Kazan river.

Back river rises in Sussex lake about fifty miles within the edge of the Barren Lands, in a basin surrounded by sandy hills, at an elevation of about 550 feet above the sea, and after a course of 600 miles in length empties itself into the Arctic Ocean a short distance south of the magnetic pole. This stream will always possess a melancholy interest for every man or woman of British stock, for at its mouth the crews of the *Erebus* and *Terror*, the two ships taken out by Sir John Franklin on his last ill-fated expedition, dropped in their tracks and died as they attempted to reach a place of safety and plenty.

Telzoa or Doobaunt river rises in Daly lake, a short distance south of the Barren Lands, and flows north-eastward, roughly parallel to the Back river, until it strikes the wide valley which extends inland from Chesterfield Inlet, where it turns abruptly eastward and flows into the west side of Hudson Bay, its total length, including Chesterfield Inlet, being 875 miles.

Kazan river rises in Kasba lake, 50 miles east of Daly lake, and flows approximately parallel to the Telzoa river for about 490 miles to enter the south side of Baker lake, though the exact position of its mouth has not yet been determined. Of the smaller streams the Anderson, Ferguson, and Coppermine are the only three which have yet been at all explored.

The permanent inhabitants of this region are about two thousand Eskimos, who live either along the coast or on the banks of the Kazan and Doobaunt rivers. They subsist entirely by hunting and fishing, and the animals on which they live are chiefly the Barren Land caribou and several species of seals.

Besides these, about five hundred Chippewyan Indians usually penetrate a short distance into the Barren Lands from the south during the summer in their annual deer-hunt, but they retire southward into the forest to spend the winter.

In this connection it may be stated that while the mean summer temperature, which we have seen is below 50° F. on the Barren Lands, determines the limit of the forest and the possibility of the growth of trees, the mean winter temperature would probably determine the habitableness of the country by human beings. Now Fort Churchill is the coldest inhabited place on this continent, with a mean winter temperature of −20·5° F., and it is not likely that any part of the Barren

Lands has a mean winter temperature of −30° F., while Yakutsk, a town of about five thousand inhabitants in Siberia, has a mean winter temperature of −40·4° F., and many other places in Northern Asia have a still lower mean, one place having a mean winter temperature of −56·2° F. Most of these places have, however, a higher summer temperature than is found in the Canadian Barren Lands, and are therefore within the limit of woods.

It can thus be seen that Europeans live and thrive in a much more rigorous climate than is found even in the most inhospitable parts of Northern Canada, and that therefore the climate does not offer any insuperable objection to settlement in that country.

Of the animals that inhabit the Barren Lands it is unnecessary to give any extended account, as all are thoroughly well known.

The Arctic caribou is the most interesting and important. They usually winter in the black spruce woods, just within the edge of the forest, living on the lichens that grow on the rocks, or that hang from, and festoon, the trees. Towards the end of the winter they leave the woods and travel across the open country to the shores of the Arctic Ocean, where the females drop their young, after which they again turn southward towards the forest.

Their flesh is excellent eating, and the animals will doubtless furnish an important food-supply for explorers and pioneers in that country. Whether they can be tamed, and thus brought permanently into the service of man, or whether they must disappear like most of the other denizens of the wilderness, remains to be seen; but even if they should be doomed to disappear, it seems quite possible that they might be replaced by tame reindeer from Lapland, who would feed in summer on the vast grassy plains, and in winter would take kindly to a diet of Canadian lichens.

Musk-oxen are the only other large herbivorous animals that live in the open plains of the north, and they scorn the shelter of the forest even in winter, their long shaggy coat of hair furnishing sufficient protection against the severest gales.

The white wolf and the wolverine are the two most common predatory animals in the interior, while the white bear and white fox are common in places along the coast.

White fish and lake trout are plentiful in the lakes and streams, but as yet very little is known about the character and distribution of the denizens of most of the water-stretches.

In my expedition of 1893 across the Barren Lands 124 species of plants were collected, exclusive of algæ and fungi. These may be grouped under the following families :—

Compositæ, 11.
Saxifragaceæ, 10.
Ericaceæ, 9.
Lichenes, 8.
Cruciferæ, Caryophyllaceæ, Salicaceæ, Cyperaceæ, Gramineæ, and Musci, 7.
Scrophulariaceæ, 6.
Leguminosæ, 5.
Rosaceæ, 4.
Ranunculaceæ, Onagraceæ, Coniferæ, Juncaceæ, Filices, 3.
Halorageæ, Vacciniaceæ, Polygonaceae, 2.
Papaveraceæ, Campanulaceæ, Plumbaginaceæ, Cupuliferæ, Empetraceæ, Liliaceæ, Lycopodiaceæ, and Hepaticæ, 1.

But it is to the minerals of this region that we must look for any large contributions to the national wealth, and failing these it is difficult to see how the country can be anything but a serious burden on those Canadians who live in the midst of more congenial surroundings. What are the prospects of finding minerals of sufficient value to induce people to open easy means of communication with that northern country, and to settle in it? Let us examine this question carefully, and I think that you will agree with me that there is much ground for hope in the future of a sub-Arctic mining province.

The western arm of the Archæan horseshoe, around which the remainder of the American continent has been built up during successive geological ages, strikes the west coast of Hudson Bay near Fort Churchill, and thence extends northward, with an average breadth of from 500 to 600 miles, to the Arctic Ocean. This Archæan belt is composed chiefly of Laurentian and Huronian rocks, but in the depressions are some large areas of rocks of a later age.

As the only exact geological information at present available is that collected by the two expeditions sent out by the Canadian Geological Survey in 1893 and 1894, which I had the honour to lead, I shall describe the rocks as seen on those two expeditions, and afterwards attempt to bring together such other information as has been recorded by others, and assign to it such value as it would seem to possess.

The Laurentian system, as here seen, consists almost exclusively of crystalline, massive, or altered crushed and contorted rocks of the "Basement Complex," consisting of granites and diorites, and granite and diorite gneisses. As a rule, the massive and foliated rocks are very similar in composition, being probably different phases of the same fluid or semi-fluid magma. These rocks are so similar to the Laurentian rocks of northern Ontario, which are familiar to any one who has spent a summer in Muskoka or in the Thousand Islands, that it is unnecessary to describe them in greater detail here. They are not usually rich in valuable minerals except where they come in contact with the overlying Huronian rocks.

On the Doobaunt river they underlie the country northward from Daly lake, and thence continue north-eastward along the west shore of Doobaunt lake and down Doobaunt river to Lady Marjorie lake, over which distance they were often seen in contact with overlying Huronian and Cambrian strata. North of Lady Marjorie lake they disappear under the Cambrian sandstones, and they were not again seen until the Cambrian belt was crossed and the north shore of Schultz lake was reached.

On Kazan river they extend from Ennadai lake to beyond Yath-kyed lake, with the exception of a small Huronian area near Angikuni lake.

On the low flat shore of Hudson Bay, between Seal river and Cape Eskimo, the few rock exposures seen were of granite and gneiss of typical Laurentian aspect. For forty miles north of Cape Eskimo no rock in place was seen, and thence northward to Baird Bay some of the points were seen to consist of granite and gneiss, though the shore generally was underlain by Huronian rocks.

On the upper portion of Ferguson river Laurentian rocks prevail, and similar granites and gneisses occur along the north shore of Baker lake, and down both shores of Chesterfield Inlet to its mouth, whence they extend southward along the shore of Hudson Bay to a short distance north of Baker's Foreland. Any information which we possess about the geology of Great Fish river and Coppermine river would seem to show that the Laurentian granites and gneisses outcrop with greater or less frequency along their banks, so that we may safely infer that the Barren Lands are largely underlain by these ancient igneous rocks, and consequently there are large areas which will not produce valuable minerals.

But as farther south we find quartzite, greywackes, and highly altered eruptive rocks of Huronian age folded in here and there with the typical Laurentian rocks, so in the far north we may confidently expect to find the same set of conditions prevailing.

Such is found to be the case in the country lately examined immediately west of Hudson Bay, where several areas of Huronian rocks, precisely similar to those found at Sudbury, Lake of the Woods, and at many places around Lakes Huron and Superior, have been discovered. The largest of these areas extends more or less continuously for 120 miles along the west coast of Hudson Bay, from near Baker's Foreland to a point 45 miles north of Cape Eskimo, and from the bay shore for 70 miles inland on the course of Ferguson river. A smaller area crosses Doobaunt river between Schultz and Baker lakes, a third occurs on the Kazan river below Angikuni lake, a fourth was recognised in the basin of Ennadai lake. Two more areas are represented by outcrops of white clastic quartzite on the north shore of Doobaunt lake, and on the east shore of Wharton lake.

The rocks constituting the system in this region have been divided into three more or less distinct groups, viz.: the Marble Island quartzites; the greenish quartzites and greywackes; and the more or less highly altered, and often schistose diabases and gabbros.

The Marble Island quartzites are composed of hard white quartzite, consisting of more or less rounded grains of quartz, of fairly regular size, cemented together by interstitial silica. They are distinctly stratified in thick and thin beds, and the surfaces of the beds are often covered with beautiful ripple-markings. The thicker beds also often show distinct false bedding. They are usually in a more or less inclined position, but they were nowhere seen to be very much crumpled or squeezed into minute folds. These quartzites on the north shore of Quartzite lake dip regularly north-westward, away from a hill of diabase which lies to the south, and the latter therefore probably underlies the quartzite, though it is not necessarily older than it. In other places very little evidence was obtained of the relative ages of the white quartzite and the other parts of the Huronian. However, it would seem probable that, in the region near the shore of Hudson Bay, this quartzite is the oldest part of the Huronian, and that the diabases, and other basic eruptions which are associated with it, have been intruded beneath it, and have also flowed over it. That the Marble Island quartzites were

PERCHED BOULDER ON A HILL IN CAREY LAKE.

BARREN GROUND CARIBOU, NEAR THE BANK OF DOOBAUNT RIVER

ESKIMO MEN FROM CAMP AT THE MOUTH OF TELZOA RIVER.

HEAD OF THE GORGE ON TELZOA RIVER BELOW DOOBAUNT LAKE.

once spread over a large portion of the region under consideration is shown, not so much by the few scattered outliers here mentioned, as by the fact that the overlying Cambrian conglomerates, which cover large areas between Doobaunt and Baker lakes, are composed chiefly of pebbles of this white quartzite.

Dark-green eruptive rocks, chiefly diabase, are largely developed in the Huronian, composing a considerable proportion of the rocks of the system. In many cases these rocks have been crushed and sheared, a slaty cleavage or schistose structure has been superinduced, and the original minerals have been broken and altered, both in their shape and composition. In other cases the rock remains massive, or there is developed in it a concretionary or bomb-like structure, the bombs, often a foot or two in diameter, being usually separated by somewhat schistose bands, which differ slightly in colour from the rest of the rock.

On the west side of Hudson Bay this rock was found to have, disseminated through it, a large amount of both iron and copper pyrites, while these minerals were often found collected somewhat more closely together in the numerous veins of quartz and calc-spar which almost everywhere traversed the rock. No large deposits of these sulphides were seen, but when they are so freely distributed through the mass of the rock it is not at all improbable that large masses may be found segregated out along the zones where these green schists are in contact with masses of eruptive granite or gneiss. Very little of the vein rock has been collected for assay, but some pieces of vein quartz, picked up by Dr. Rae near the south side of Corbet's Inlet, were found to carry a small amount of gold.

On the Great Fish river, Mr. Pike speaks of the ironstone formation, of dark fissile slates or schists, probably belonging to the Huronian system, extending down the river from Musk-Ox lake to Beechey lake, a distance of 75 miles.

The shores of Point lake, one of the expansions of the Coppermine river, have been described by Sir John Richardson, who passed through that country in company with Sir John Franklin in 1821, and from his descriptions there is no difficulty in recognising the Huronian rocks. The following is his description of the rocks, slightly condensed :— "Greywacke passing into greywacke slate,—greywacke with small imbedded crystals of hornblende,—dark greenish or blackish grey,—clay-slate. Several of the islands in the lake consist of greenstone. A rock standing apart from the neighbouring hills on the border of the lake, having a rounded summit, but bounded on three sides by mural precipices about 200 feet high, is composed of compact earthy greenstone, containing disseminated iron pyrites, covered with layers of greenstone slate. On the north side of the lake there is a high bluff hill with a precipitous side, which seems to consist principally of a conglomerate. The basis is earthy-clay slate. The imbedded masses have an ellipsoidal form and smooth surface, are from one to two feet in diameter, and appear to consist of the same material as the basis, but impregnated with much silica, and not showing evident slaty structure. When broken they present an even fine-grained fracture.

"During our first and second days' journey down Point lake from the above-mentioned encampment, being 11½ miles on a WNW. course, the rocks we had an opportunity of examining consisted of greenish grey clay-slate, generally having a curved structure, and splitting into slates of very unequal thickness."

From these few isolated and widely separated occurrences it may be seen that, as in the Archæan areas of northern and western Ontario, so on the Barren Lands, Huronian rocks occur at more or less frequent intervals, squeezed in between adjacent areas of Laurentian granite and gneiss.

That these belts of Huronian rocks will eventually prove of great economic importance, there can be no doubt whatever. In Ontario the wonderful general richness of these rocks is just beginning to be recognised, but from them were taken in 1896 gold to the value of $121,000, nickel to the value of $1,189,000, and copper to the value of $320,000; while in the states adjoining Lake Superior the total production of iron ore in 1895 from these rocks was 10,269,000 long tons, valued at about $20,000,000. This was 62·31 per cent. of the total amount of iron produced in the whole United States. The rapid progress with which these mines are being developed is shown by the fact that the Mesabi range was first opened up in 1892, and in 1895 the product of the mines in the range was 2,800,000 tons. Thus you will see that in these rocks there is a prospect of discovering extensive deposits of valuable minerals.

But perhaps the most interesting rocks known in the Barren Lands are those which are regarded by the Canadian Geological Survey as being of Lower Cambrian age, and which are very similar in character to the Nipigon or Keweenawan rocks of Lake Superior.

In the exploration of the country recently made these rocks were first met with about the centre of the west shore of Doobaunt lake, whence they were found to extend north-north-eastward for 125 miles to the forks of the Doobaunt river. From this point they were traced eastward for 175 miles to the outlet of Baker lake, at which point they veered off to the south. Towards the west this series probably extends a long distance up the valley of Thelew river, and may perhaps cross the low watershed and connect with similar beds on the shores of Great Slave lake.

The basal portion of this series is here represented by reddish thick-bedded sandstones and conglomerates, which are comparatively unaltered and undisturbed over large areas. In some places, as on the islands near the north-west shore of Doobaunt lake, they dip regularly at a moderate angle. The pebbles in the conglomerates are well rounded and water-worn, and consist almost entirely of white clastic quartzite like that of the Marble Island (Huronian) beds. The occurrence of quartzite pebbles, to the almost total exclusion of pebbles of Laurentian or other rocks, would indicate that these Cambrian strata were deposited off a shore composed very largely of Huronian quartzites. The sandstones and conglomerates are cut by dykes and masses of both acid and basic eruptive rocks. The acid eruptions were first met with on a hill of red quartz-porphyry at Teall Point, on the west shore

of Doobaunt lake. A similar massive quartz-porphyry forms a heavy east and west dyke some distance farther north on the shore of the same lake, and in the vicinity of the dyke the surrounding conglomerate is very much hardened, so that it breaks indifferently through the matrix or through the pebbles.

Towards the north end of Doobaunt lake the orthoclase in the rock is replaced by plagioclase, the porphyry thus becoming a porphyrite. This porphyry is largely developed, and seems to underlie a large tract of country, along Doobaunt river between Lady Marjorie lake and the Forks, and again it was found on the islands towards the east end of Baker lake.

Dark-green basic eruptions, chiefly, or perhaps exclusively, in the form of dykes, are extensively developed throughout the area covered by the rocks of the Cambrian system. On Doobaunt lake and on Doobaunt river near the Forks, most of these dykes are of typical diabase, with interlocking lath-shaped crystals of plagioclase, between which are crystals, or crystalline masses of augite, often altered to chlorite.

A heavy diabase dyke, crossing the Doobaunt river at Loudon rapids, cuts the surrounding acid eruptions, and is clearly newer than they. It is also interesting to note that the rocks in this vicinity are very freely stained with green carbonate of copper, indicating the presence of a considerable amount of copper disseminated through the rock, just as copper occurs under similar conditions in similar rocks south of Lake Superior.

Lithologically the whole of this terrain presents a remarkable resemblance to the red sandstones and quartz-porphyries of the Keweenawan (copper-bearing) rocks of Lake Superior. This resemblance is so strongly marked that small hand-specimens of the rocks from the shore of Doobaunt lake are usually indistinguishable from specimens from Lake Superior.

Native copper was nowhere found, but it is not at all unlikely that it may occur in the vicinity of some of these basic dykes.

Farther west, however, native copper has been known to the Indians and Eskimos from time immemorial, and the first journey that was made by a white man into the northern country, 118 years ago, was made in search of this deposit of copper. The locality was visited by Sir John Richardson in 1821, and again in 1826. We have no record that the place has been visited since then. Dr. Richardson's descriptions show that some of the rocks which occur on the banks of the Coppermine are precisely similar to those on Doobaunt and Baker lakes, though they also indicate the occurrence of the underlying Animikie series, and they also show that the conditions under which the copper there occurs are very like those under which it occurs on the south side of Lake Superior.

The Keweenawan rocks would appear to have been first seen by him on Red Rock lake, a short distance below Point lake, on the Coppermine river, and thence they occupy the banks of the river through most of the distance down to its mouth.

At the "Rocky Defile," "the walls of the rapid" are said to "consist of a very dark purplish red, compact felspar rock, alternating with a rock which is composed of a light reddish and greyish felspar and quartz,

the former indistinctly crystallised," evidently referring to different varieties of quartz-porphyry or porphyrite. "This rock is everywhere exposed in the bed of the river for ten or twelve miles below the rapid."

In the beds of torrents flowing into the main river he found many rock fragments, most of which were probably derived from rock in places in the vicinity, and the list might readily be duplicated from the copper-bearing rocks of Lake Superior; he mentions "fragments of reddish grey, granular, foliated limestone, of deep red sandstone, of grey sandstone, of red syenite. There also occur fragments of pale red sandstone, composed principally of quartz and a little felspar, with imbedded circular concretions of quartz, and of reddish quartzite sandstone. Fragments were also found of dark-greeny felspathose trap, of greenstone, of dark flesh-red felspar in granular concretions, with imbedded patches of hornblende, of red felspar partly coloured with hornblende, and containing amygdaloidal portions of prehnite."

"The Copper mountains consist principally of trap rocks. The great mass of the rock in the mountains seems to consist of felspar in various conditions; sometimes in the form of felspar-rock or claystone, sometimes coloured by hornblende and approaching to greenstone, but most generally in the form of dark reddish-brown amygdaloid. The amygdaloidal masses contained in the amygdaloid are either entirely pistacite (epidote), or pistacite enclosing calc-spar. Scales of native copper are very generally disseminated through this rock, through a species of trap tuff which nearly resembles it, and also through a reddish sandstone on which it appears to rest. The rough, and in general rounded and more elevated parts of the mountain are composed of the amygdaloid, but between the eminences there occur many narrow and deep valleys, which are bounded by perpendicular mural precipices of greenstone. It is in these valleys, among the loose soil, that the Indians search for copper. Amongst the specimens we picked up in these valleys were plates of native copper; masses of epidote containing native copper; of trap rock with associated native copper, green malachite, copper glance or variegated copper ore, of greenish grey prehnite in trap with disseminated native copper: the copper in some specimens was crystallised in rhomboidal dodecahedrons. We also found some large tabular fragments, evidently portions of a vein consisting of prehnite, associated with calcareous spar and native copper. The Indians dig wherever they observe the prehnite lying on the soil, experience having taught them that the largest pieces of copper are found associated with it. The Indians report that they have found copper in every part of this range, which they have examined for thirty or forty miles to the north-west. We afterwards found some ice-chisels in possession of the Esquimaux, twelve or fourteen inches long and half an inch in diameter, formed of pure copper."

The surrounding country is underlain by a light-brownish red sandstone and grey slate clay in horizontal strata, cut here and there by dykes of greenstone.

It is hardly possible to imagine two more similar sets of conditions in such widely separated localities, as in the Copper mountains and on

Keweenaw Point, the native copper occurring in both places associated with prehnite and epidote, chiefly in an amygdaloid cut by dykes of greenstone.

The copper-bearing rocks would seem to extend along the Arctic coast, both east and west of the Coppermine river, for about 500 miles in all, and probably many of the smaller islands off the coast are also of the same rocks, and the total area covered by these rocks undoubtedly amounts to many thousands of square miles.

Comparing the early accounts of the occurrence of native copper on Lake Superior with the accounts which we now possess of the copper on the Coppermine river, and considering the enormous extent of the northern deposit, we have reasonable ground for hope that before many years the Coppermine area will produce as much copper as is now raised in northern Michigan. The amount there raised in 1896 was 144,000,000 pounds, valued at between fifteen and sixteen million dollars, or about a sixth of the total amount of copper mined in the world that year.

Besides copper, a narrow vein of pure galena has been found on the shore of Bathurst Inlet.

Whether any other metals but copper and lead will be found in that region remains to be discovered, but the evidence of the presence of Animikie slates and limestones would indicate the possibility of the occurrence of silver, such as was found at Silver Islet on Lake Superior.

This northern country, which, as we have seen, gives abundant evidence of rich mineral wealth, has up to the present been very remote from any settlements, but now it can actually be reached with very little trouble and expense either from Mackenzie river or from Hudson Bay, and its general even unmountainous character would render the building of roads across it a matter of comparatively little difficulty.

From the Mackenzie river to Great Bear lake is only 65 miles, and from that lake to the Coppermine river only another 65 miles, while the Keweenawan rocks on Baker lake may be reached by ocean-going steamers which can ascend Chesterfield Inlet to its head, which is open for three months of the year. From the head of Chesterfield Inlet it is only 400 miles, over a gently undulating country, to the east end of Great Slave lake, or 580 miles to the Copper mountains west of Coppermine river.

South of Chesterfield Inlet good harbours doubtless exist, from which the Huronian rocks could readily be explored, or, if rich mines were discovered, which would serve as means of access and outlet to and from those mines.

Port Churchill, at the south-eastern extremity of the Barren Lands, has long been known as an excellent harbour, having been surveyed by Joseph Robson, an engineer, as long ago as 1746. On an average it is open five months of the year, from June 19 to November 18, the shortest open season known being four months and eight days, and the longest season five months and eighteen days.

It is true that in going to live in that northern land, one would leave far behind the forest, meadows, and pleasant orchards of this beautiful province, but the wealth torn from the rocks would enable the people to

procure all the products of more genial climates; and with the health and strength derived from a well-fed, but active and energetic existence, the country would be covered with homes as happy as could be found in any part of the world.

THE KHEDIVIC POSSESSIONS IN THE BASIN OF THE UPPER UBANGI.

By S. H. F. Capenny.

(*Continued from page* 86.)

Orography and Hydrography.

It is now possible to get a full and systematic view of the whole Upper Ubangi basin. The probability is that in a remote age it was a separate hydrographic system. The middle section of the Ubangi, from Mokoangai to Yakoma, which is called the Dua, is evidently the long and narrow bed of an ancient lake. When its waters attained the col between it and the valley of the (Lower) Ubangi its effluent scooped out in the course of ages the Zongo Gut through the chain of hills which here runs east and west. Hence the Ubangi has been described as merely a kind of canal which conducts to the Congo the waters of the Welle and the Mbomu.[1]

Orographically the basin of the Upper Ubangi is dominated by the Meridional Divide which separates the basins of the Nile and the Zambezi from the basins of Lake Chad and the Congo. In the north, at the Dar Fertit tableland, it forms the triple watershed of the Shari, Ubangi (Kotto and Shinko), and Nile (Bahr-el-Arab and Bahr-el-Ghazal); at the district of Ndóruma it forms the triple watershed of the Welle (Werre and Gurba), the Mbomu, and the Bahr-el-Ghazal (Sue or Jur); at the massive orographic system in which the Mitumba chain terminates to the west and north-west of the Albert Lake it forms the triple watershed of the Welle (Obi and Zoro), the Nile (Bahr-el-Jebel and Albert Nyanza), and the Ituri or Upper Aruwimi. From Yakoma, the altitude of which is some 1410 feet (430 m.), the valleys of the Upper Ubangi basin rise in a succession of terraces to these several watersheds, the altitudes of which are 2500 to 3000 feet, 2440 feet, 4265 to 4600 feet respectively. Where the descent is abrupt, according to the formation of the terrain, the channels are marked by rapids and falls.

Wélle is a Zande word which means "river" or "stream," and is now the generally received name for the river throughout its entire length from Yakoma to its source. Another Zande word which is current, especially among the western A-Zande, is *Mákua* or *Makwa*. Among the Mombattu the word in use is *Kíbali*. When all are used, and

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[1] "Régime des eaux" in *Rapport sur le climat de l'État Indépendant du Congo*. Par MM. Lancaster et Meuleman. Bruxelles, 1898, p. 312.

a distinction is made between them, Kibali is the name of the Upper Welle from its source, or from the junction of the Obi and the Zoro, to the confluence of the Gadda, that is, throughout the Mombattu districts; Welle is distinctively used for the middle section; Makua for the western section. *Makua* and *Kibali* have much the same meaning as *Welle*.

But which is the main artery of the Welle? Is it the Obi or is it the Zoro? It has been common to describe the Welle as coming from the orographic system to the west of the Bahr-el-Jebel, where the Kibi and Sir unite to form the Obi. It has been found, however, by the agents of the Congo State, that the branch which comes from the south-east is the more important feeder, and the Zoro or Iret is now regarded as the main stream of the Welle.[1]

The Welle, then, rises at an altitude of some 4265 feet (1300 m.) in the Lendu highlands, that is, in the southern part of the mountain region to the west of the north end of the Albert Nyanza, and flows north-west to Surure, in the Logo territory, where it receives the Obi, the head streams of which rise in the Lubari highlands, that is, in the northern part of the same mountain region to the west of the Bahr-el-Jebel. On the right bank the Welle receives, besides the Obi, the Dongu, the Duru, the Kápili, the Mbrúole (or Bruole), the Gurba, and the Werre; on the left bank, the Gadda, the Bomokándi, and the Mbima (or Bima).

The Dongu rises in the Kalika highlands, to the south of Janda (or Ganda), the altitude of which is 3815 feet; its most important tributary is the Akka, which rises in the Tomaya highlands, and receives the Garamba from the Tendia tableland. The Duru and the Kapili come from the Baginze highlands. The Mbruole rises in the Wando territory, and receives on the right bank the Tau, which comes with its tributary the Makusa from the Ubangi and Nile divide between Wando and Ndoruma. The Gurba rises in the Ndoruma district. The Werre, too, rises in the Ndoruma district, and receives on the right bank the Duma from the same district, the Fallu or Fullu from the Mbomu divide, and the Bitapo from the Mbili divide. The divides which form the watersheds of these several tributaries are most of them hardly perceptible.

The Gadda and the Bomokandi rise among the offshoots of the Mitumba chain, which penetrate into the Welle basin and form the divide of the Welle and Ituri basins. The Nala, the Telli, the Pokko, the Makongo, all of which are left-bank tributaries of the Bomokandi, and the Mbima come from the hilly district and tableland which form the divide of the Welle and Aruwimi basins. The divide of the Welle and the Rubi is hardly perceptible.

[1] This was a probability that came within the ken of Emin. In a letter to Schweinfurth, written from Tomaya, August 10, 1883, on his way back from Mombattuland, he wrote as follows:—"To judge from information I have received from some of our men who came from the south, it seems that Junker's Kibi must be considered as only a tributary of the true Kibali, and that the latter river comes from the south-east; probably, therefore, from the mountains on the western shore of the Albert Lake. From the north-east it receives the waters of two other important tributaries besides the Dongu and Kibi. I send you this as an *on dit*, with all reserve, and put off its verification to a future occasion."—*Emin Pasha in Central Africa*, London, 1888, p. 456.

The total length of the Welle from its head to Yakoma is some 808 miles (1300 kil.); its total fall is some 2855 or 3000 feet, that is, from 4265, 4297, or 4593 feet (1300, 1310, or 1400 m.) at its head to 1377, 1426, or 1436 feet (420, 435, or 438 m.) at Yakoma. At Dongu its altitude is 2329 feet (710 m.); at Nyangara, 2231 feet (680 m.); at Amadi, 2132 feet (650 m.); at Mbima, 1771 feet (540 m.); at Ali Kobbo, 1443 feet (440 m.). From the Welle to the Bahr-el-Ghazal divide the rise is gradual, without any abrupt elevations.

The length of the Dongu is some 180 miles (290 kil.); of the Werre 211 miles (340 kil.); of the Bomokandi 341 miles (550 kil.).

Down to the vicinity of Surure the Welle or Kibali (Zoro) is a mere mountain stream, from 164 to 246 feet wide (50 to 75 m.), which is cut up by innumerable rapids, and not usable for boats even by the natives. Half-way between Dongu and Nyangara it issues from the mountain region, but isolated eminences are met with along both banks down to Bomokandi. Above Amádi, between Mt. Angba on the north bank, and Mt. Majánu on the south bank, the valley of the Welle becomes narrowed to a mere pass or gut, which is called Magarágare. Between Dongu, where it is some 260 feet wide (80 m.), and Bomokandi, however, the width of the river varies from 246 feet to 984 feet (75 to 300 m.). Between Bomokandi and Yakoma it varies in width from 1640 to 3281 feet (500 to 1000 m.). At Ali Kobbo it is some 5000 feet wide (1500 m.). At Jabbir it is only 656 feet (200 m.) wide, but above and below it is some 5900 feet (1800 m.). Down to Mokwangu, where the Ubangi navigation terminates, the Welle is cut up into navigable lengths by rapids and falls, the most important of which are above and below Dongu, above Nyangara, at Magaragare, below Amadi, half-way between Amadi and Bomokandi at the Panga Falls of some 8 feet (2 m. 50), at Bomokandi, Mbima, Siasi, and at a succession of rapids below Jabbir, terminating in the Mokwangu Falls, of nearly 10 feet (3 m.). The period of its highest level is October and November; of its lowest, February and March; with a difference of 12 to 16 feet (4 to 5 m.) between Amadi and Yakoma. Downward from Bomokandi, and even from Amadi and Nyangara, the course of the Welle is dotted with islands and islets, many of which are of considerable size, wooded, and remarkable for vegetation.

The Mbomu (or Bomu) rises in the vicinity of Baráni, who is a son of Ndoruma. It trends first to the north-west and then to the west. It receives on the right bank the Boku, Kango, Kelle (or Kerre, of Marchand), the Bamu (or Bakary, of Marchand), Warra, Shinko, and Bali; on the left bank, the Aza, Gona or Gurua, Assa, Dupa, Duma, Dongotollo, and Mbili (or Bili). It retains its own name throughout its entire course; but among the Sakkara it is known as the Kengo.

The Boku rises in the Pambía mountains, and receives on the right bank the Rongo, 15 yards wide, and the Kammo, 15 yards wide, on the left bank. Above the Kammo, but below the Rongo, to the east of Linda, the Boku was, at the end of November 1883, 20 yards wide and 18 inches deep, with high and steep banks and a sandy bed. The Kango comes from Mt. (Nbia) Baindiri. The Kelle, 40 yards wide, rises at Mt. Dara-

gumba. The Bamu, 30 yards wide, rises in the hilly divide of the Warra. The Warra and its right bank tributary, the Goangoa, rise to the west of Dem Bekir; the Goangoa, south-east of Ombanga, at the end of April 1883, was found to be 50 yards wide, with a deep rapid current between steep high banks: the Warra at its confluence is 80 to 100 yards wide. The Shinko is formed by the union (7° 40′ N. lat.) of two small streams, called Kpakpe by the Krej, which rise about 8° N. lat., the one from the vicinity of Buko, the other from the Gatta mountains. It receives on the right bank the Mbulu (or Bulu), 65 feet (20 m.) wide, which comes from the north; the Lowa, which comes from Mt. Bafau and receives the Loto, some 50 feet (15 m.) wide, from the north-west; the Kengi, which comes from the north-west through the Aja territory; the Tatara, some 98 feet (30 m.) wide, which comes from the north-west, from the Vidra territory, and receives the Wamma; the Ngaua, which comes from the north-west and receives the Atangu at Darbaki. On the left bank the Shinko receives its most important tributary, the Babado (of the A-Zande), or Barango (of the Sakkara), or Woworo (of the A-Banda), which comes from the NNE., rising to the west of Dem Zubeir, and receives on the left bank the Bitti or Bitta and the Ali; where it joins the Shinko, the Babado is some 197 feet (60 m.) wide. The Shinko is from 984 to 1148 feet wide (300 to 350 m.) at the Mbomu, and 197 feet (60 m.) wide at Bandassi, up to which point it is navigable by boats (pirogues) during high water.[1] The Bali comes from the north-east, and rises near Mt. Bafan, about 7° 20′ N. lat. and 24° E. long.; it receives on the right bank the Kubu, Waka, Duru, Zako with its feeder the Kwettu, Kuru, and Sandigi; on the left bank, the Kanga, with its right-bank feeders, the Bataito and Bailo, and the Pennet. The Bali is navigable up to Basso, or 6° N. lat., where some falls arrest navigation. The most important of the Mbomu tributaries on the left bank is the Mbili, which receives the Gangu, with its feeder the Dangu; north of Jabbir it is some 280 feet (85 m.) wide; the Gangu, in the vicinity of Bansinge, is some 130 feet (40 m.) wide.

The Mbomu is some 430 to 450 miles (700 to 720 kil.) in length. Its fall from Barani to Abira (or Yakoma) is from 2428 or 2461 feet (740 to 750 m.) to 1410 feet (430 m.), say 1020 to 1050 feet. Down to the Warra, some 200 miles, there is a total fall of 680 feet, of which two-thirds in its upper and one-third in its lower course, 90 and 110 miles respectively. North of Deleb it is 100 yards wide, below Sassa 150 yards, at the Warra 250 yards wide. Down from the Warra it is from 200 to 800 yards wide, say a mean width of 500 yards. The Ubangi navigation terminates 16 miles (25 kil.) up, at Wangu, between which and Madabungu there are rapids and falls. Between Madabungu and Sandu, at the Shinko, there are several rapids, and the Gufuru or Ngufuru Falls. From Sandu, according to the report of Marchand, it is usable for boats up to Mere. The Mbomu is described as a superb

[1] In October and the end of 1882, Lupton found it 50 yards wide and 15 to 20 feet deep near Bandassi; 80 yards wide and 30 feet deep near Marra.—*Petermanns Mitteilungen*, 1883, p. 311.

river, deeper than the Welle, and dotted with islands covered with oil palms.[1] The period of its highest level is October and November; of its lowest, February and March.

The Kotto rises near the Kaya (or Kaïa) mountains, about 9° N. lat. and 23° 30′ E. long. Its length is some 420 miles (675 kil.); it is navigable for some 22 miles (35 kil.), from the Ubangi up to some Falls of 82 feet (25 m.); and at the confluence it is 738 feet (225 m.) wide and 13½ feet (4 m. 20) during high water. The period of its highest level is October; of its lowest, January. Another name for it is the Bandu.[2] The upper Kotto is probably the Sabanga of Potagos.

The healthy tableland of the meridional divide from Ndoruma to Dar Fertit is worthy of notice at this moment in view of current discussion as to delimitation and the rights of the Khedivate. Ndoruma is in the basin of the Welle, while Barani is in the basin of the Mbomu, which rises a little to the south-west. To the south of Barani several streams go to the Werre; to the west the Duma, a tributary of the Werre, has its source; to the east several streams go to the Bikki, which is a tributary of the Sue or Jur. The summit of the divide then passes north along the Pambia chain, which forms the watersheds of the Boku and the Sue. Between the Mbomu and the Wau basins it becomes a broad-crested, rising ground, and then a wooded, hilly district, above which rise, in order from south to north, the three mounts, Baindíri, Daragúmba, and Makámba. From Dem Bekir to Buko it is an elevated tableland, as indicated by the following altitudes:—Dem Bekir, 2480 feet; Buko, 2574 feet; Dem Zubeir, 2060 feet, or 1985 according to Lupton; Anyauer, 2190 feet; Ombanga (or Mbanga), 2267 feet; Marra, 1980 feet; Mbaferi, 2299 feet. Between the basins of the Kotto and the Bahr-el-Fertit the summit of the divide, according to De la Kéthulle, is hardly perceptible. According to his itinerary from Rafai up the valley of the Shinko to Katuaka on the Ada the country rises insensibly in a succession of terraces, like a series of immense steps, to a vast, undulating plain with here and there chains of hills such as the Gatta and Kaya (or Kaïa) mountains, both of which have a mean relative height of 1968 feet (600 m.).

(To be concluded.)

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[1] De la Kéthulle, *op. cit.*, p. 400. Le Marinel's "La Région du Haut-Ubangi ou Ubangi-Dua."—*Bulletin de la Société belge de Géographie.* Bruxelles, 1893, p. 8.

[2] This is the correct name, according to the Duc d'Uzès, who says the river is improperly named the Kotto.—In a letter home from the Ubangi, February, 1893: *Le Voyage de mon Fils au Congo*, p. 226, par la Duchesse d'Uzès, Paris, N.D. According to Julien, Bondu is the name current among the Yakoma; Kuta, among the Bugbu (Bubu), etc.; and Kota, among the Sakkara. Nowhere did he hear it called Koto. "Du Haut-Oubangui vers le Chari par le Bassin de la rivière Kotu."—*Bull. de la Soc. de Géographie.* Paris, 1897, p. 369.

THE GERMAN DEEP-SEA EXPEDITION.

(*With a Chart.*)

GERMAN physicists, substantially assisted by their Government, are now taking the lead in oceanographical research. The results of their efforts in the Baltic and Arctic seas and elsewhere have been from time to time noticed in these pages, as well as the proposed Antarctic expedition, which will in all probability be ready to sail next year. At the present time an expedition of no small importance is cruising in the Indian Ocean. In 1897, at a meeting of Deutsche Naturforscher und Aertze in Leipzig, Professor Chun of Leipzig proposed that a deep-sea expedition for zoological observation should be organised, and at the suggestion of Professor Ratzel the scope of the expedition was enlarged to include chemical and physical observations. The German Government approved of the scheme, and the Parliament voted £15,000 towards the cost, which will be supplemented by additional grants to cover the expenses of the expedition and the publication of the results.

The directors of the Hamburg-American Company, with patriotic liberality, agreed to fit up a vessel, the *Valdivia*, of 2600 tons and 1250 horse-power, with deck-house for microscopic work, laboratories, and apparatus, to give the services of the ship's company and supply provisions and all other necessaries for a scientific cruise, for the sum of only £17,000, not seeking to make any profit out of the transaction. The *Valdivia* is under the command of Captain Adalbert Krech, who was at one time a whaling captain, and the scientific staff consists, besides Professor Carl Chun, of Professor W. Schimper of Bonn, botanist; Drs. Karl Apstein, Ernst Vanhöffen, and Fritz Braem, zoologists; Dr. Gerhard Schott of the Deutsche Seewarte, oceanographer; Dr. Paul Schmidt, chemist; Herr Sachse of the Hamburg-American Line, navigator; and Dr. M. Bachmann, doctor and bacteriologist, each of whom receives eight shillings a day from the Government. Dr. August Brauer and Dr. Otto L. zur Strassen, zoologists, and Herr F. Winter, draughtsman and photographer, have also sailed with the expedition, but have no official status.

The *Valdivia* sailed from Hamburg on August 1st, and having called at Granton, where the scientific members landed to visit the *Challenger* Office and accept the hospitality of Sir John Murray, sailed round the north of Scotland to the Canary Islands, touched at the Cameroons, the mouth of the Congo and Walfisch Bay, and stayed a few days at Cape Town. The results of the soundings and temperature observations taken from the Wyville-Thomson bank to the Cameroons were briefly noticed in last month's number of the *Magazine* from a preliminary report of Dr. Gerhard Schott, published in the *Annalen der Hydrographie*. The work accomplished by the expedition after leaving Cape Town is indicated in the following letter from Professor Chun to Sir John Murray and in the accompanying chart:—

"I enclose a sketch of our route, and may add that we advanced farther into the Antarctic region than we at first thought to be possible. We were only

100 nautical miles from Enderby Land, and there dredged up from a depth of 4647 mètres (2541 fathoms) a large quantity of stones which were not of volcanic origin.

"I had the course set for Bouvet Island, and we were fortunate in finding this island so often searched for in vain. It was no easy task for Captain Krech in stormy weather and fog, and amidst icebergs, to hit the mark. Bouvet Island lies in 54° 26′ S. lat. and 3° 24′ E. long. It is entirely covered with glacier ice, is steep and inaccessible. Apparently it consists of a volcanic cone with a broad crater edge. We found basalts and tuffs in the dredge.

"From Bouvet Island we sailed through 50 degrees of longitude along the pack-ice, usually in calm weather. What most astonished me was the great depth; we frequently sounded over 3000 fathoms. The Antarctic sea is certainly much deeper than has hitherto been supposed.

"From Enderby Land to Kerguelen we encountered violent storms, and did not meet with any improvement until we reached St. Paul.

"I hope to send you soon a detailed report, in which the temperature series and chemical analyses will receive special attention.

"I grieve to say that our doctor (Dr. Bachmann) died in the Indian Ocean. All the other members of the expedition are in good health."

Bouvet Island, now re-discovered by Professor Chun's expedition, was sighted by the French merchant captain Bouvet, in 1739, and named Cape Circumcision, as it was believed to be a promontory on an extensive land area—the Southern Continent, then still believed to exist. The position being given 54° S. lat. and 11° 20′ E. long., Captain Cook failed to find it in 1772, and subsequent navigators were equally unsuccessful. In 1808 James Lindsay and Thomas Hopper, two sealing captains, discovered an island in the neighbourhood, and also Norris, in 1823, sighted land, and Thompson discovered an island on which one of his boat's crews was detained six days by bad weather. Whether these islands are really distinct or not, it is impossible to decide at present.

The achievements of the expedition are worthy of all praise, and the results, when worked up, cannot fail to add materially to our knowledge of the ocean and its life. Especially remarkable is the series of soundings taken on the edge of the pack from Bouvet Island to the neighbourhood of Enderby Land, considering that the *Valdivia* was not strengthened for ice navigation, and would have been in considerable danger if the weather had been stormy. No such line of soundings has hitherto been taken in high southern latitudes, for the only other vessel properly equipped for scientific research which has visited these seas was the *Challenger*, which made, however, only a flying visit to the Arctic circle, whereas the *Valdivia* skirted the pack for a long distance, and will no doubt bring home much fresh knowledge of the oceanography and fauna of those seas.

Seeing how much has been done by an expedition making merely a deviation southwards in the course of a voyage through the Atlantic and Indian Oceans, British oceanographers will regret the backwardness of their own country. In spite of the opinion repeatedly expressed by scientific men on the desirableness of a properly equipped scientific expedition to the South Polar regions, the necessary funds are not forthcoming up to the present. Such an expedition as has been proposed, with

parties wintering on shore, can alone obtain meteorological and magnetic records throughout the year, and gain some insight into the nature and extent of the Antarctic continent. But the present experience shows that a vessel protected for ice navigation, with an efficient scientific staff on board, could reap a rich harvest during the summer months. Surely in this wealthy country there ought to be friends of science willing to contribute the £20,000 to £30,000 required for the purpose. Or have all scientific enthusiasm and spirit of enterprise died out in the greatest maritime nation in the world?

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Election of Members.

At a meeting of Council held on February 28th, the following gentlemen were elected Members of the Society :—

Henderson, W. J. | Scott, A. W. | Sturrock, Chas.

Lectures delivered in February.

A lecture on the Caroline Islands was delivered in Edinburgh, on February 14th, by Mr. Fred. W. Christian. Mr. Chas J. Guthrie presided. This lecture will be published in the *Magazine*.

Mr. J. Y. Simpson was unfortunately prevented by illness from addressing the Society at Edinburgh and the Branches.

Lectures in March.

Mr. G. E. H. Barrett-Hamilton will address the Society in Edinburgh on March 16th. His subject will be Kamchatka.

Lady Colvile will lecture in Edinburgh on Madagascar, on March 28th.

Mr. A. H. Savage Landor will deliver an address at Aberdeen, on March 7th, to the members of the Society and of the Association of Teachers of the Secondary Schools of Scotland (Aberdeen Branch).

GEOGRAPHICAL NOTES.

By The Acting Editor.

EUROPE.

The Population of France.—The figures lately published for the year 1897 are more discouraging than those of former years. The births, 859,107, were 6479 fewer than in 1896, and the number is the lowest in any year of the century, except in 1871. Certainly the mortality was also very low, the deaths numbering only 751,019, the lowest number since 1845. The ten years' mean is 841,000. The total population being 38,269,091, the births are 22·4 to 1000 inhabitants, and

0·3 less than in the preceding year. The marriages steadily fell from 1870 till seven years ago, when they were 7 to the 1000 persons; since then they have slightly increased, being now 7·6 per 1000. On the other hand divorces have also become more numerous, being 7051 in 1896 and 7460 in 1897, an increase of 5·8 per cent.—*Deutsche Rundschau*, Jahrg. xxi. Heft 5.

The Navigation of the Loire.—The longest and one of the most beautiful rivers of France is not at present utilised as a channel for commerce and travel. A few barges laden with merchandise ply between Nantes and Saumur, but beyond this town vessels are rarely seen. This, however, was not always the case. During the Middle Ages and, indeed, up to quite recent times, there was considerable traffic along the river. In the first half of the present century it reached its highest development; thousands of boats swarmed on the river as far up as Briare, and a service of steamboats was established in 1823 between Nantes and Angers, and was subsequently extended to Orléans. The prefect of the Loiret reported in 1844 that 197 boats entered the port of Orléans between February 7th and 13th, and that the labour was insufficient to unload the cargo, which was valued at about £500,000. Twenty years later this activity had vanished, and the traffic was almost entirely transferred to the railways, for the Loire is defective as a waterway. Its chief defect is want of water. Sometimes, swollen by prolonged rains, it has risen 22 to 26 feet and caused disastrous inundations, as in 1846, 1856, and 1866, but more frequently its bed is almost empty. From April to October the river consists as a rule of a few narrow threads of water running among innumerable banks of yellowish sand in the most capricious windings, so that the course of the stream is about one-third longer than that of the banks. The islets and sandbanks are constantly changing their position, and every year old channels are blocked up and new ones opened. Owing to the want of water, navigation never lasted more than six or eight months in the year, so that the boatmen were obliged to find some regular occupation on land during the rest of the year; and even in the height of the season their boats often ran aground.

In 1895 an association, called the Société de la Loire navigable, was formed at Nantes, and with its assistance the Government has drawn up a scheme for the improvement of the waterway, which is being put into execution, so that in a few years boats may again ply between Nantes and Orléans either in the bed of the river, or, where this cannot be deepened and regulated to accommodate boats drawing 6 to 6½ feet of water, by a lateral canal.

Meanwhile a steamer has been constructed which promises to contribute much to the revival of navigation. This vessel, called the *Fram*, has twin-screws, is 135 feet long by 18 broad, is flat-bottomed, and with its coal bunkers full draws only 11 inches. With its full cargo of 80 tons it draws 27½ inches, and can steam at the rate of 7½ to 9 miles an hour. It has already made a trial trip, leaving Nantes on Aug. 27th, and arriving at Blois on the 31st, and a few days later continuing its voyage to Orléans. Though the water had seldom been so low, no difficulty was experienced except where the channel was almost entirely silted up. —*A Travers le Monde*, 1899, No. 2.

The Coal Seams of Spain.—The want of coal is severely felt in Spain. English coal, of which 600,000 tons are yearly imported into Barcelona, is so dear that its use in industries is not to be thought of. Such a state of things is singular, considering the wealth of coal in the country, and is only to be accounted for by the indifference and lack of energy of the Spaniards. At present in all Catalonia

only two mines are worked, those of Calaff and San Juan de las Abadesas. The output from the former was large years ago, but the mine has been neglected because the coal is said to contain a large proportion of sulphur. The latter yields coal of a very poor quality that can only be used in the form of briquettes. There are, however, other seams which might be profitably worked, one of which is at Llobregat. A more extensive field, more than 96 square miles in extent and containing about 220,000,000 tons of coal, lies in the north of the province of Teruel. The seams lie immediately beneath the surface, so that they can be worked with little trouble and expense. A scheme for a railway, 56 miles long, to Barcelona has been approved by the Cortes, but under the present circumstances no further steps will probably be taken, through the communes interested have given the land necessary. Besides coal, this district has rich deposits of iron, lead, and copper ore, so that all the conditions for an active industry are at hand. In Benabarre, in the province of Huesca, are also coal-fields yielding excellent fuel, but these have scarcely been touched. A railway 14 miles long to Barcelona is projected. Though the Spanish capitalists do not lack money, there is little prospect that the mineral resources of the country will be energetically and judiciously exploited until foreign capitalists and experts undertake the task.—*Mitth. der k.k. Geogr. Gesell. in Wien*, Bd. xli. Nos. 10 and 11.

The Meteorology of Mt. Etna.—Almost isolated from the mountain system of Sicily, the summit of Mt. Etna presents a very suitable point for the observation of the meteorology of the higher regions of the atmosphere. The observatory is situated on the Piano del Logo, 1217 feet below the summit, at an altitude of 9650 feet above sea-level. A thermo-barograph was set up in 1892, as the observatory is not permanently inhabited, and it is almost impossible to reach it in winter on account of the snow. This instrument has not acted satisfactorily, but from simultaneous observations at the high-level station and at Catania, 200 feet above the sea, some conclusions have been arrived at. The mean annual temperature on Mt. Etna is 32·7° F., or 31° lower than at Catania; the summer mean is less than the winter mean at Catania, and the monthly means from November to April inclusive are all below freezing-point. The means for the seasons on Mt. Etna and at Catania respectively are: winter 20·1°, 50·5°; spring 29·3°, 58·6°; summer 45·1°, 76·8°; autumn 36·9°, 66·5°. The decrease of temperature with altitude is 1° for every 311 feet. The range is less on Mt. Etna than at Catania; the daily range is 7°. The maximum temperature observed is 66·4° and the minimum 8·2°.

The annual atmospheric pressure is 21·02 inches, or about seven-tenths of that at Catania. During the summer it is 0·39 inches higher than in winter. The mean relative humidity is 65 per cent., a little higher than at Catania. The most prevalent wind is north-west, and the west comes next. Snow and rain almost always come with these winds.

The frequency and quantity of the precipitation is less than at Catania. While, however, at the latter place snow rarely falls, at the observatory it covers the ground to a depth, sometimes, of sixteen feet. It falls between the middle of October and the end of May. The lower limit of snow varies from 4900 feet in winter to 10,800 feet at the beginning of summer.—*Ciel et Terre*, Feb. 1st.

ASIA.

Laos and Annam.—M. J. M. Bel landed in January 1897 at Qui-Nhon, a small town on a large bay into which the river Binh-Dinh pours its waters. He

then ascended the valley of this river, passing the town of Binh-Dinh, celebrated for its manufacture of yellow silk crépons, and An-Nhon where vermicelli, bean paste, and rice paste are made. He then crossed the Anke chain by a pass 1560 feet high, beyond which the village of Anke stands on a plateau drained by the Song-Ba, which enters the Chinese Sea near Phu-Yen. The plain between the Anke range and the sea is surrounded by wooded hills 1000 to 1300 feet high, is densely peopled and admirably cultivated. As many as three crops of rice are gathered in during the year. The Anke chain is formed of crystalline rocks, pegmatite and diorites predominating. M. Bel then entered the country of the Khas. The homes of this people are built on piles and arranged in streets, which are generally kept very clean. The Khas are a simple people, entirely cut off from foreign influence, and at present distrustful of strangers. Their villages extend along the route for 120 miles to Attopeu, the first Laotian village on the Sekong. The pass into the basin of the Mekong lies 3000 feet above sea-level. The watershed is composed of eruptive rocks, gneiss, and crystalline schists, and is covered with virgin forest. From Attopeu M. Bel ascended the Sekong about 35 miles to examine some copper mines. He also visited the province of Quang-Nam in Annam to examine the mineral resources.

Summing up the results of his investigation, M. Bel states that there is an extensive auriferous zone in the country of the Khas, which was also observed in Annam on the slope of the Chinese Sea. The Khas also work in iron and bronze, and their country contains argentiferous lead, and perhaps tin. Being elevated high above sea-level it enjoys a fresher climate than the rest of Indo-China; in February the temperature at an altitude of 1600 feet sank to 50°, and rose to a maximum of 86°. The ground is fertile, and seems capable of producing a large variety of crops. In the Annamite ranges are grown tea, coffee, cinnamon, sugar, cotton, indigo, besides rice, which is cultivated everywhere. The inhabitants of the districts visited by M. Bel are capable of furnishing valuable labour at a very low price. Roads and railways are the great necessity, especially as navigation along the rivers is difficult.—*Bull. de la Soc. de Géographie*, 3e trim. 1898.

AFRICA.

The Administration of the Egyptian Sudan.—A convention was signed at Cairo by Boutros Pasha and Lord Cromer regulating the administration of the southern provinces. The name Sudan is used to designate all the lands south of the twenty-second parallel of latitude which have never been evacuated by the Egyptian troops since 1882, as well as those which have recently been reconquered by the British and Egyptian Governments acting in concert. The British and Egyptian flags will be hoisted in all parts of the Sudan, except in the town of Suakin, where the Egyptian flag will float alone. The supreme government of the Sudan will be intrusted to a governor-general appointed by a decree of the Khedive with the sanction of the British Government. The laws, decrees, and regulations affecting the country may be modified or abrogated by the governor-general by proclamation, of which notice must be given to the British agent in Cairo and the president of the Khedivial Council. No Egyptian law or decree not at present in force will be applicable to the Sudan unless the governor-general sees fit to adopt it. In the regulations regarding the conditions under which Europeans may reside and trade or acquire property in the Sudan, no preference shall be shown to the subjects of any particular Power. Custom-dues shall not be levied on goods entering the Sudan through Egyptian territory, but they shall be levied on those

coming from elsewhere. At Suakin, however, and other ports on the Red Sea, duties equivalent to those paid by merchandise entering Egypt from foreign countries shall be exacted. On goods leaving the Sudan duties may be levied, and these may be modified from time to time by proclamation. The jurisdiction of the mixed tribunals shall not be extended to any part of the Sudan, except Suakin. Except in this town, martial law shall be maintained for the present. The importation and exportation of slaves are absolutely prohibited, and the two Governments will give their special attention to the application of the Brussels Act of 1890 relating to the importation, sale, and manufacture of firearms, ammunition, and spirituous liquors.

From the Mobangi to Lake Chad.—Details of the journey of M. Gentil to Lake Chad are given in the *Revue Française* for December. M. Gentil left France in 1895, with the steamer *Léon Blot* in sections, and ascended to Ouadda on the Mobangi, whence he made his way up the Kemo, already visited by Dybowski. Finding it navigable only for a short distance, he explored the Tomi, which proved to be navigable up to Krebedje. This was a gain of 75 miles out of the 190 between the Mobangi and the Gribingui. The watershed between the basins is not conspicuous, having a relative altitude of not more than 330 feet. The *Léon Blot* was put together on the Nana, which enters the Gribingui, discovered by Maistre, after a course of 48 miles. Unfortunately rapids extend for a distance of five miles on this river, the water falling about 300 feet, and consequently the vessel had to be taken to pieces and reconstructed below the rapids. The country between the Mobangi and Gribingui is in general flat and lies at about 1400 feet above sea-level. Gums, raphia, and borassus afford pasturage for abundant game; antelopes and elephants are found in large troops, and hyænas and leopards are the most common beasts of prey. The population is dense, and all the tribes except the Mandjias speak the same dialect. Their houses are round, low, and constructed of adobe roofed with thatch. The land around the villages is planted with millet, maize, cotton, and a little manioc. The domestic animals are only goats and fowls. Large uncultivated areas lie between the villages, which are frequently at war with one another, and these constitute hunting-grounds. The men are not handsome, and the women are soon aged by labour in the field. Spinning and weaving are done by the men, who can produce coarse blouses.

On August 21st, 1897, the *Léon Blot* started down the Gribingui, then in flood, and on the 30th entered the Banimgui, Bahr-el-Abiad or Shari, more than 100 yards wide; below the confluence the river measured 200 yards. Three important affluents were noted before the Kaba Bodo were reached, in whose country Maistre ended his journey. The natives wear only a leather apron behind. They own horses, sheep and goats, and catch fish. The vessel then passed rapidly through the territory of the Tounia and came to the Niellim, the first pagan tribe subject to the Sultan of Baghirmi. The influence of the Mussulmans on these tribes is very striking; the Bussoa, who fifty years ago were in the same condition as the tribes nearer the Mobangi, are now clothed, and have made great progress in civilisation. On arriving at Bougouman M. Gentil turned back up the Bahr Erguiez (narrow river), another channel of the Shari, and landed at Maggi to visit the Sultan of Baghirmi at Massenia. The ramparts of the town were partly destroyed by the people of Wadai in 1870, and the town had not been restored because the Sultan Gourang, after his struggle of five years with Rabah, had intended to abandon it. Since M. Gentil's return Gourang has been driven out of Massenia, which he burned before leaving.

Returning to the main arm of the Shari, M. Gentil recommenced his voyage to Lake Chad on October 20th. On the 27th he passed the mouth of the Logone, a fine stream with a rapid current. Above Goulfei the river divides into three arms before entering the lake. M. Gentil chose the arm passing Goulfei, and on October 30th, 1897, steamed into the lake, which he navigated for twenty miles. The banks on this side are not marshy, and are easily accessible. At one point an elevation 1625 feet high was noticed, and a group of small islands appeared in the distance. M. Gentil then quickly retraced his steps to the Mobangi. The garrisons of Rabah on the lower course of the Shari retired on the approach of the *Léon Blot*, and the natives were friendly towards the travellers, for which they were afterwards punished by Rabah. One of the affluents of the Shari on the right bank has a considerable discharge, and this may prove to be the main channel of the river.

Dar-es-Salaam.—Herr A. Seidel, Secretary of the Deutsche Kolonialgesellschaft, has published a little pamphlet on the capital of German East Africa. The town lies in 6° 49′ S. lat., and 39° 10′ W. long., at the mouth of the Msimbasi, a tiny stream of no commercial importance, and surrounds in a crescent a fine roomy bay almost circular in outline. To this position the town owes its name, for Dar-es-Salaam (contracted from Bendar-es-Salaam) signifies "harbour of peace." Between a promontory and a coral reef a narrow channel, with seven fathoms of water and over, gives access to the harbour, where there is deep water close up to the shore; opposite the fort there are seven to nine fathoms up to forty yards from the strand. The shore is for the most part sandy, even at the few spots where it is covered with mangrove-bush, and rises in thirty paces to a height of forty feet. The soil is light and friable, and vegetation is somewhat scanty. Coco-palms and mangoes are the most common trees.

The climate is characterised, as at other parts of the coast, by a damp, close, tropical heat, a small daily range of temperature, and a constant relatively high humidity. In April 1891 the daily maximum averaged 88° F., and the minimum 76°; for June the figures were 77° and 68° respectively. The highest temperature of the year, 90°, occurred in April, and the lowest, 66°, in June. From January to April it is very hot, damp, and oppressive. Heavy rains in May cool the air, and with July begins the cool season, which lasts till October. The months from November to February are sometimes almost dry, sometimes rainy; then comes a rainy season of three months, followed by five months with little rain. Consequently the sanitary conditions are not very favourable to Europeans. The town contains 279 Europeans, mostly Germans, and 177 of them Government officials.

Dar-es-Salaam is an emporium for caoutchouc and copal, which come from the southern districts of the territory. Also from April 1896 to March 1897 about 3200 pounds of ivory were exported. In this article the other ports of the territory surpass Dar-es-Salaam. On the whole, however, its trade is increasing in a greater ratio than that of Bagamoyo. From Herr Seidel's description it may be gathered that at present the town is of far more importance as the centre of administration and missionary enterprise than as an industrial or commercial centre.

Currents at the Straits of Bab-el-Mandeb.—In January 1898 Lieut. H. J. Gedge proceeded in H.M.S. *Stork* to examine the currents at the mouth of the Red Sea. The *Stork* was anchored seven nautical miles south-west by south of Perim, in 118 fathoms, and remained there four days, when the breaking of the cable put an end to the observations. A constant surface current passes into

the Red Sea with a velocity about $1\frac{1}{2}$ nautical miles an hour. At about 105 fathoms a constant current of about the same velocity flows outwards. The tidal current runs in each direction for 12 hours, with a maximum velocity of $1\frac{1}{4}$ miles an hour, and with varying velocity extends to the sea bottom. The boundary between the upper and lower permanent currents is at about 75 fathoms; further observations are necessary to determine its exact level. The observations were executed with the Pilsbury current meter as modified by Capt. Usborne Moore.

AMERICA.

Exploration of Central Alaska.—During last spring six parties entered Alaska, besides a large force despatched by the U.S. Coast and Geodetic Survey to map the entrance to the Yukon river. Two army expeditions, accompanied by the geologists Messrs. Mendenhall and Schraeder, were landed at the mouth of the Copper river and started for the Yukon, the one in a northerly, the other in a north-easterly direction. Their work was co-ordinated with that of the Geological Survey parties, so that the topographical and geological results should supplement each other. Of the Geological Survey parties two were to start from the head of Cook's Inlet, and travelling north-eastwards and north-westwards respectively, rendezvous at St. Michael's. Two others were to cross the White Pass from Skagway, one of which was to ascend White river, and crossing over to the Tanana, follow this river and the Yukon to St. Michael's, while the other was to make a detailed survey of about 2000 square miles near Circle City.

One of the parties which landed at Cook's Inlet ascended the Sushitna river under the conduct of Mr. Eldridge. A short distance from the inlet the river branches into several large streams, of which the chief are the Chulitna, apparently the main stream, and the Yantna, both flowing from north and west, while the branch which keeps the name Sushitna bears north-east. This stream the party followed, and crossed the watershed at a height of nearly 3000 feet to the head-waters of the Tanana. Finding great difficulties in the way of a descent of the Tanana, which moreover was on the route of another party, they then returned by the way they came. A mountain between the forks of the Chulitna and Yantna was identified as Mount Bolshaia, and its height determined as a little over 19,500 feet. Should this height be verified by office computation and the observations of the second party, the mountain will be recognised as the highest in United States territory.

The second party, under Mr. J. E. Spurr, accompanied the former as far as the forks of the Sushitna, crossed the watershed on the west to the Kuskokwim river, floated down it on rafts as far as Oknamagut, and then passed over to the Yukon. As the season was not far advanced, they returned to Oknamagut and continued their voyage to the mouth of the Kuskokwim, ascended the Togiak river to Tikchik lake, and thence crossed the watershed to Nogheling river and Lake Clarke, returning to Cook Inlet before the close of navigation.

The White river party, under Mr. J. W. Peters, ascended a small tributary, falling into the main stream not far from its mouth, for two or three hundred miles, and made its way north-westwards to the Tanana river; while the fourth party, under the direction of Mr. E. C. Barnard, measured a base line and extended a system of triangles, accompanied by careful topographic survey, over 2000 square miles of territory adjacent to the international boundary. From their data a map will be drawn on the scale of four miles to an inch, with 200-feet contours.

One of the Army expeditions, commanded by Captain Glenn, started from the

head of Cook's Inlet, and followed the Matarmska river east of the Sushitna, and crossed over to the Copper river, while a detachment made its way across the Tanana river and the head of Birch creek to Circle City. Captain Glenn's party also crossed the Kenai peninsula from Cook's Inlet to Cape Resurrection. Captain Abercrombie's party was landed at Prince William Sound, whence it proceeded with great difficulty over the Valdes glacier, came to the Copper river, and reached the Tenana by the Mantasta pass, and descended Forty-Mile creek to the Yukon. —*Bull. of the American Geogr. Soc.*, vol. xxx. No. 5.

The U.S. Coast and Geodetic Survey expedition sounded the depths on the bars at the mouths of the river, and surveyed the coast by land as far as the Aphoon, the branch by which vessels coming from the river reach St. Michael's. Another detachment examined the Kusilvak mouth, which it found to be the deepest of all the mouths. It lies twenty-five miles farther north than it is marked on maps. At ebb-tide there are eight feet of water on the bar, whereas there are only two at the Aphoon mouth; but the Kusilvak is so winding that it will be difficult to navigate, and buoys cannot be laid down because of the ice.—*Globus*, Bd. lxxiv. No. 24.

British Columbia.—In the report of the British Columbia Board of Trade for last year, the progress of lode-mining is shown to have been very rapid since 1898. The district of West Kootenay contributed ninety-five per cent. of the output, which is accounted for quite as much by the facilities of transport afforded by natural waterways and short lines of railway as by the richness of the ores. East Kootenay has not increased its output to any appreciable extent, but now that the Crow's Nest Pass Railway has reached Kootenay Lake, greater activity may be expected. The silver-lead mines of Slocan have been very profitable. Hitherto the ore has been smelted in the United States at heavy cost in freight and duty. Two smelters in Kootenay are now preparing to treat lead ores. In Cariboo the surface workings are nearly cleared out, and drainage will probably be required for deeper mining, while hydraulic power is costly. The Cassiar, Omineca, Skeena, and Stikine districts offer great attractions to placer miners, who believe them to be as rich in gold as the country farther north, while the climate is better and the imposts much lighter. The output of Vancouver Island coal is very satisfactory, and a new industry, the manufacture of coke, has sprung up. Iron-ore of a very high grade, quicksilver, and less important minerals, are also found in the province.

The catch of salmon in 1897 exceeded the previous highest record by fifty-eight per cent. The increase was exclusively on the Fraser River, and is accounted for by the hatchery established there in 1884. The sealing industry has fallen off in consequence of the restrictions imposed by the Behring Sea Arbitration in 1894.

The lumber trade is expanding owing to an increase in the foreign demand. The wooded area is about 285,000 square miles, and includes forty kinds of timber; 502,617 acres are leased. Agriculture is steadily spreading.

The Crow's Nest Pass Railway, from Lethbridge to Kootenay Lake, a distance of 300 miles, now gives direct communication with eastern Canada. A railway from Robson to Penticton, already commenced, will open up the Boundary Creek country, a promising mining district. A subsidy has been voted by the Provincial Government for its continuation to the coast, one of the conditions being that the company shall maintain a ferry between the mainland and Vancouver Island. A grant has also been voted to aid in the construction of a line, 230 miles long, between Bute Inlet and Quesnelle, but there is no certainty that it will be commenced at present. Operations have been commenced in connection with the

Cassiar Central Railway, from Glenora to Dease Lake, a distance of about 99 miles, but the contractors of the Glenora and Teslin line are waiting for some additional assistance from the Dominion Government.

Basins of the Plains, United States.—The surface of the high plains of the west, in general level, are dotted over with shallow basins varying in depth from two or three feet up to those nearly 100 feet deep, with a breadth of one or two miles. Mr. Willard D. Johnson points out that these depressions may be caused by unequal subsidence of the stream-built sands and gravels which form the plains, or they may be due to actual removal of particles by solution, forming channels which are at length broken by the overlying earth. Where the depressions are in the form of pits or funnels, sudden subsidence into caverns has no doubt taken place, but most of the depressions are of gradual growth. The most remarkable case of subsidence is that of a sink-hole which was suddenly formed in March 1879, near the town of Meade, in southern Kansas. A wagon passed on March 3rd over the site where, 23 days later, a deep, sharp-edged pit, 175 feet across, was found. It is now an oval with a maximum diameter of 215 feet. Cracks extend outwards over an area of 525 by 275 feet. The depth, 89 feet in 1879, has been reduced to 54 feet by the falling in of the banks. When first noticed the water was 75 feet deep, being above the adjacent water level. Probably the roof had fallen into a cavern full of salt water, and afterwards the water gradually returned to the normal level by percolation. There is no salt in the adjacent ground water, but a well at the rim of the pit was sunk down to impure rock salt at a depth of 325 feet. A very singular phenomenon is the occasionally high temperature of the water of the pit. The surrounding ground water has a constant temperature of 59° F. The surface water of the pit has a varying temperature, since it is exposed to the sun. On one occasion when the surface temperature was 89° F. the bottom temperature was 156° F. After several cloudy days the temperature at the bottom fell to 98° and at the surface to 76°. In the test well the temperature of the rocks was found to be normal, rising about 11° in 325 feet.—*Bull. of the American Geogr. Soc.*, vol. xxx. No. 5.

The Rio Grande.—A case is now pending in the Supreme Court of the United States which involves the question of the navigability of this river. Though the Rio Grande is important as forming the boundary between the United States and Mexico, it is probably not generally known that its bed above the middle of its course is dry for months at a time, while again it is sometimes suddenly filled by an impetuous torrent which fills up old channels with its alluvium and opens new ones, leaving many square miles of Mexican territory on the northern side of the deepest channel, or cutting off Texan ranchers from communication with the rest of the State. On subsiding the water leaves a train of wreckage behind it, and interminable controversies as to right of the United States and Mexico to certain pieces of land. Above El Paso the Rio Grande has never been used as a waterway, and is still less capable of being so used since dams were erected two hundred years ago at El Paso for the purposes of irrigation. The main stream of the Rio Grande, if the direction and volume be taken as a criterion, is the Pecos, the stream above the confluence being to a certain extent intermittent.—*Bull. of the American Geogr. Soc.*, vol. xxx. No. 5.

Mona and Monito.—About half-way between San Domingo and Puerto Rico lies the small island of Mona, in former times a haunt of pirates, and of late come into notice through the phosphates stored up in its caves. To most people the Mona Passage is probably more familiar than the island from which it derives its name.

Dr. Th. Hübener, in *Globus*, Bd. lxxiv. No. 23, describes the island as an enlarged copy of Heligoland, as it rises steeply from the sea on the north and north-east. Elsewhere there is a lowland belt bestrewn with blocks and fringed with coral reefs. The main mass is a block of rock 1000 to 1300 feet high, with an almost level surface. It is composed of porous sandstone, so that it is completely honeycombed. Old strand lines also are observable, and at their level are situated the large caves, many of them filled with forests of stalactites and stalagmites. The air within the caves is at a high temperature, 86° to 88° F., and is saturated with moisture.

The floors of most of the caves are covered with guano, or, more correctly, phosphates. When the caves were at a lower level, and the sea water could freely enter them, large quantities of animal and vegetable remains were washed in and subjected to a long process of decay, in the course of which all organic structure was destroyed. After the ground rose, the deposits were exposed to the air, and washed by the rain water that trickled into the caves, so that in many places they consist of pure phosphates. Similar caves exist on the coast of Puerto Rico, but the phosphate in them is so impregnated with iron as to be almost worthless.

Signs that the caves were once resorted to by pirates are still to be seen, especially on the north-west side of the island, and hence there has been a widely prevalent belief that treasure is hidden there ; indeed, it is said that twenty years ago an American did actually find valuables worth about 15,000 dollars.

The rocky nature of the ground prevents the development of vegetation even in a tropical climate. Where a small quantity of soil has accumulated in a hollow a few bushes grow, cactus and its allies being most common. The flora affords little nourishment for man ; cocoa-nuts, prickly pears, and a few berries are the only edible fruits. On the other hand, animal life is abundant—cattle and goats, birds of many kinds both land and marine—and the sea swarms with fish.

Monito is nothing but an isolated rock about 500 yards in diameter, rising straight out of the water without any outlying reefs. The upper surface of the rock, 100 feet above the sea, is somewhat troublesome to reach. Cactus is as common here as on the larger island.—*Globus*, Bd. lxxiv. No. 23.

The Discovery of the Rio Madre.—Señor Luis Ulloa has published in pamphlet form a narrative of the expedition of Juan Alvarez Maldonado to the Rio Manu, or Madre, in the years 1567-69. The manuscript of this narrative is in the Archivo General de Indias, and was perhaps written by Hernando Alonso, who accompanied the first party under Manuel de Escobar to the country of the Toromanas, and afterwards lived ten months among the Opataries. In the Introduction Señor Ulloa adduces evidence to prove that Maldonado was the first to reach the banks of the Rio Madre ; that the account Garcilaso de la Vega gives of an expedition of the Inca Rocas to the headwaters of the Madre is a conglomeration of events connected with the conquest of Antisuyo by the Inca Ynpanqui, an expedition of the Incas to the Moxos of the Rio Beni, and the expedition of Maldonado himself ; and that no other Spaniard reached the river before Maldonado.

Maldonado, having received from the Spanish Crown a grant of the country on the east of the Andes as far as the Atlantic, and southwards to 18° S. lat., set out from Cuzco for the purpose of taking possession of his dominion. At the headwaters of the Madre de Dios he founded the town Del Vierzo, and lower down beyond a gorge (Coñec according to Señor Ulloa) he established the port of Buena Vista. Here he built boats and rafts, and despatched a party under Manuel de Escobar to make a settlement on the lower river, and plant crops preparatory to his own arrival. Escobar established a post in the country of

the Toromanas, who dwell between the Madre de Dios and the Mamore, but his party was cut to pieces by the Indians, and Maldonado's own party suffered so severely from their attacks that but for the interposition of the cacique of the Taramonas probably not one would have returned alive.

As far as the conquest of the country was concerned the expedition was, then, a total failure, but the geographical gains were important. Señor Ulloa identifies all the rivers mentioned in the narrative, and about many of them no doubt can exist, as they bear the same names at the present day, such as the Cozñipata and the Pilcopata. The Paucargambo, flowing through the territories of the Manaries, Señor Ulloa identifies with the Manu of Señor Fiscarrald; below it the river is called the Magno or Manu by the author of the narrative. The Indians and the vegetation, etc., are also correctly described. The narrative is a valuable addition to the history of exploration.

OCEANIA.

Dutch New Guinea.—The narrative of a journey in New Guinea, by E. St. Vraz is published in *Petermanns Mitt.*, Bd. xliv. No. 10. The traveller reached New Guinea on November 8th, 1896, in a vessel which anchored off the small island Mansinam opposite Doreh. This tongue of land is inhabited by fully 1000 Papuans, besides about 100 strangers who deal with the natives for bird of Paradise skins, Damara resin, sea-slugs, turtle, and sometimes pearls. Doreh, which appears on maps as a village lying on the opposite shore, is really a collection of groups of huts which are built on piles at some distance apart. Of these groups there are seven. On November 24th, M. St. Vraz sailed to the mouth of the stream named Andai in order to make an excursion into the Arfak mountains. After following the course of the stream for three miles, his party turned to the south and commenced the ascent of the mountains, which here rise to a height of 4300 feet, arriving in the evening at an extensive plateau, 1000 feet above sea-level, bordered to the south-east by the Hatam mountains, and sloping down to the sea at the north-east. A spur of the Hatam runs into the plain, forming the watershed between two small streams which unite in the Warmeri. The vegetation on the plain is much more scanty than elsewhere in the neighbourhood, and birds are more numerous than in the gloomy forests of the Hatam.

Following the Meni, one of the above-mentioned rivulets, upwards, M. St. Vraz then turned eastwards over a ridge 5300 feet high and several other lower ridges, reaching on the fourth day the village of Mieni, the first huts he had seen after leaving Arfak. The buildings of the Hatam people are precisely similar to those of the Arfak natives. During the night an earthquake disturbed the traveller, a common occurrence in those mountains. From Mieni he descended to the brooks Mingangoja and Mingantiyega, and on December 17th came in sight of the valley of Hatam, which he named after D'Albertis. At its end Hatam Kaku (great) is scattered over an area of more than 40 square miles. Neither D'Albertis nor any other traveller has reached this village, as their guides pretended that Moreh and Little Hatam, nearer the coast, were Great Hatam.

The D'Albertis valley, or rather the slopes of the mountains, some of which rise to 6500 feet, is inhabited by the Hatam people, who are sharply distinguished from the Nuforg and Arfak people by their language, ornaments, and style of hair-dressing. They much resemble the Moreh natives, and are no doubt the original inhabitants, who have been thrust back into the interior by the Nuforgs and Arfaks. The Hatams number about 1000 or 1200 at most.

From Great Hatam M. St. Vraz pushed on thirteen miles farther into the

interior towards the south and south-west. A third range running west-south-west parallel to the Hatam ranges he proposes to call the Beccari mountains, and another independent elevation, separated by a deep valley, the Smetana mountains. Farther he could not go, for his men fell ill with fever, though the air was fresh and the heat moderate, never exceeding 75° F. and falling at night to 48°. Behind the Beccari and Smetana mountains the country is uninhabited. The knowledge of the Papuans of the interior is very slight. South of the middle part of the D'Albertis valley, about 20 miles distant, is said to lie a large lake named Chemti, swarming with fish and crocodiles, on the eastern shore of which dwell the Manikioans, while beyond live the Hirai tribe, which is accused of cannibalism.

Pitcairn Island.—This island in the southern seas is well known as the resort of the mutineers of the *Bounty* in 1790. It is about two miles long from east to west, and about one broad. It has no coral reef like the other neighbouring islands. The cliffs, clothed with luxuriant vegetation, rise straight from the sea in picturesque outlines. The landing-places, of which Bounty Bay on the north coast is the one most generally used, are difficult of approach and constantly lashed by surf. Adamstown and its plantations are situated on a plateau overlooking Bounty Bay from a height of 430 feet. To the south the plain gradually rises to the foot of the steep chain which traverses the island from east to west and falls precipitously to the south coast. This ridge of dark, basaltic lava culminates in two points at the east and west, the highest, Lookout ridge, attaining to 1108 feet. The soil is fruitful, and coco-palms and breadfruit-trees were introduced by the settlers. Brooks and springs are scarce, and rainwater has to be used for drinking.

In 1856 part of the population was transferred to Norfolk island; the remainder have now increased to 141. Fair and blue-eyed persons are common, though they are descendants of Tahitian women. The administration consists of a president and a parliament of five members elected annually by the women as well as the men. The president's house contains an organ, given by the Queen, of which the islanders are very proud. The other public building is the parliament house, which also serves as a church and school. There was no minister till 1896, the grown-up men conducting the service in turn. About once a year a British man-of war brings them clothing and luxuries, and then, if necessary, judicial cases are disposed of, but serious crime is very rare. When a murder was committed in 1897, the judge of the Fiji islands had to make a voyage to Pitcairn island to try the criminal. Alcoholic drinks and tobacco are forbidden.—*Globus*, vol. lxxv. No. 5.

The community is not as innocent and happy as might be supposed. In recent correspondence published by the Colonial Office the people are described in the following terms: "Lax in morals, weak in intellect, they are fast degenerating, and unless something is speedily done to alter their condition they will probably drift into hopeless imbecility." Living in almost complete isolation, and procuring food with little trouble, they have no incentive to exercise their mental and physical powers.

ARCTIC AND GENERAL.

Geology of Franz Josef Land.—Notes by Dr. R. Koettlitz on his observations as geologist to the Jackson-Harmsworth expedition are published in the *Quarterly Journal of the Geological Society*, No. 216. The plateau-like aspect, which characterises districts largely composed of horizontal sheets of basaltic rock, is very conspicuous at a considerable distance. All the exposed headlands are

formed of successive, sharply defined tiers of basalt, which, though occasionally rising to a height of 1000 feet, do not form the most lofty elevations. Behind them, on a clear day, a rounded surface of snow and ice may be seen rising to a higher level—in a few cases, perhaps, to 2000 feet. Snow and ice also fill the depressions between the headlands and masses of rock, descending to sea-level and ending abruptly in an ice-face 10 to 80 feet in height. At the base of the cliffs is an extensive talus covered with moss, grass, and other plants, and in some places thickly strewn with large blocks, and below this again raised beaches are usually found. The land is evidently the remains of an old tableland which has been broken up into an archipelago.

The basalt occurs in layers 10 to 70 feet thick, separated by laminated beds, sometimes only a few inches, but generally 2 to 4 feet, thick, and occasionally much more. These intermediate layers are formed in part of stratified rocks, sometimes composed of sand, shale, or micaceous sandstone containing lignite. The lower part of some of them is a tuff-like rock, described by Mr. Teall as decomposed basalt, basaltic scoria, and basalt-tuff. Dr. Koettlitz gives evidence in support of his view that the basalt was not intruded as sills between older rocks, but was laid down on the surface. The lower, at least, of the basalts, he believes to be of Upper Jurassic age, not because of the presence of a piece of *Ammonites Lamberti*, which might have been picked up by the lava as it flowed over the Oxfordian beds, but because the flora of a bed between the second and third tiers of basalt is believed by Dr. Nathorst to be of that age. This was not, however, accepted as conclusive proof by the geologists present when the paper was read before the Society. Siliceous rocks of various kinds occur abundantly in association with the basalt, and silicified wood is very plentiful, whence Messrs. Teall and Newton have inferred the probable existence of geyser action.

Stratified rocks have been found at Capes Neale, Grant, and Stephen, at Cooke's Rocks, Cape Flora, Cape Gertrude, and Wind Gully. At Cape Neale a soft yellow coarse sandstone occurs dipping at an angle of $1\frac{1}{2}^\circ$ to 2° north-east to north, and at Cooke's Rocks is a hard calcareous sandstone containing abundant plant remains, which Mr. Newton states bear a strong resemblance to the vegetation of the Permian age. The sedimentary deposits of Cape Flora are about 600 feet thick, and extend from the sea-level to the base of the basalt; they chiefly consist of soft shales, sands, and sandstones. The lowest strata seen contained large *Avicula* and *Belemnites*. A plant bed was discovered on the north side of Cape Flora, overlying a mass of basalt which projected from the ice at a height of 750 feet. It was from this bed that the specimens submitted to Dr. Nathorst were taken. At Cape Gertrude, barely four miles to the eastward, the strata differ markedly from those at Cape Flora. The only organic remains found were fossil wood and lignite, except a nodule of radiolarian chert.

Raised beaches are of common occurrence, most of them lying below 80 or 100 feet. At Cape Flora they also occur between 240 and 340 feet, with walrus and seal bones and rounded waterworn pebbles. In some places, as on Bell Island, the rivulets have washed down gravel and sand on to the floe-ice, which is thus protected from the sun's rays, and does not melt. If the land then slowly rises a raised beach gradually comes into existence with a layer of ice beneath it. A similar covering of gravel over ice has been constructed at Cape Mary Harmsworth, but in a different way. The floe-ice, here subject to great pressure, has thrust large quantities of beach stones on to the land ice.

The ice-cap, in Dr. Koettlitz' opinion, is of no great thickness, for it clearly shows the terraced form of the land beneath, and in summer the more prominent

edges of the rocks are exposed. The ice-faces, also, are of no great height, and the largest icebergs seen by the expedition did not rise more than 50 to 80 feet above the water, and these were tilted so that they appeared thicker than they really were.

The Kola-nut is highly valued in West Africa from Lake Chad to Senegambia, and from the lands south of the Congo to the oases of the Sahara, and even as far as Fezzan, Tripoli, and Morocco. In the southern part of this region the demand is met partly by local cultivation and partly by importation; while the north, particularly the Hausa States, is dependent entirely on imported nuts. The exporting lands are two small areas in the west. One of them comprises Sierra Leone, North Liberia, the most southern parts of Senegambia, and the source regions of the Niger—Kuranko, Timisso, Sangara, etc. In Ashanti and the adjoining Anno, Baule, and Worodugu the tree can be cultivated only in a narrow belt, not more than 60 miles broad, lying at a distance of fully 120 miles from the coast. It is from these two areas that the Sudan is supplied, for the indigenous nut of Adamaua and Lower Guinea is consumed only in these countries, and is considered to be of little value. The French districts of Koba and Sakata alone supply 590 tons, while the export of Sierra Leone during recent years has been returned at 49 tons. These figures relate almost entirely to fresh nuts, for the dried nuts, which might easily be used in Europe, are bought only in times of scarcity. The price in Sierra Leone is 5½d. to 13½d. per lb., and in Gambia and Goree 11d. to 24½d.

The kola-nut, which, like cocoa, contains theobromine, is the fruit of a Sterculiacea, called *Sterculia acuminata*, *Sterculia cola*, and *Cola acuminata*. There are two varieties, one with narrow, the other with broad, leaves. The fruits, six to twelve in number, lie in woody pods 3½ to 6 inches long, and resemble chestnuts in size and colour; their taste is slightly bitter. The kola-nut contains more theine than the best coffee, and this constituent is free, not combined as in coffee with an organic base. Its proportion of theobromine is large, and a considerable quantity of glucose, together with three times the amount of starch present in cocoa, render it a very nourishing food. At present little is known about the cultivation of kola, or of the climatic and other conditions under which it thrives best. It grows wild in the Cameroons, and is in some places cultivated by the natives. It is only during late years that it has here attracted attention as an article of export, and the quality is such that it fetches only about 4¾d. per lb.—*Deutsche Rundschau*, Jahrg. xxi. No. 2.

MISCELLANEOUS.

The Railway from **Merv to Kushk** was opened on December 16th.

The **Lagos railway** is making satisfactory progress, and the rails have been laid down to within a few miles of Abeokuta.

In December the British flag was hoisted on **Chusan**, the largest island of the group of the same name. The archipelago lies at the entrance of the gulf of Hang-chau, about a hundred miles south of the mouth of the Yang-tse.

The **Seventh International Congress of Geologists** will be held in Paris from August 16th to 28th, 1900. The duration of the congress is extended beyond the usual time to enable the members to visit the Exhibition and museums. Numerous excursions have been arranged.

The construction of the **Simplon tunnel** was commenced on August 1st. The tunnel will have a single track, and will be 21,580 yards (about 12¼ miles) long, while the Mont Cenis is 13,503, and the St. Gothard 16,387. At a later date a second tunnel will be constructed parallel to the first, and at a distance of 19 yards from it. The northern entrance to the tunnel will be 2700 yards from the present station of Brieg at an elevation of 2254 feet; the exit on the Italian side will be 800 yards from Isella.—*Revue Française*, January.

The **Société de Géographie de Toulouse**, which has ever since 1893 been advocating the application of the decimal system to the measurement of time and angles, will take the opportunity of the Congrès des Sociétés Savantes, which will be held at Toulouse, April 4th to 8th, to organise an exhibition of time-keepers, instruments, etc., divided according to the decimal system. The Society invites all who own instruments of this kind or who have published diagrams, pamphlets, etc., on the subject to forward them for exhibition.

By a treaty with the Sultan of **Raheita** in 1880 Italy acquired by purchase the northern part of his territory, while the southern part was placed under the protection of Italy. The southern boundary of this territory towards the French colony of Obok remained indefinite till last November, when it was agreed between the two Powers that the boundary should run from Ras Dumeirah at right angles to the coast, passing about two and a half miles to the south of the town of Raheita, which accordingly remains in the Italian territory. Italians interested in colonial affairs affirm that their country has thus lost twenty-two miles of coast, but on the other hand a fruitful source of quarrel has been removed.

An active volcano has been discovered at Atlin lake on the border of the **Yukon** district. It is one of four lofty cones which rise considerably above 13,000 feet. In October attention was drawn to the mountain by a thick cloud that hung over the summit without moving, but all doubt as to its nature was dispelled on November 8th by an eruption, which covered the country around with a layer of ashes several inches deep, while the glow of the lava lighted up the night.

Mount Lefroy was ascended in August 1897 from Lake Louise by Messrs. Thomson, Dixon, and Abbott. The height, as measured by an aneroid, is 11,425 feet.

The city of **Athens** has expanded rapidly during the past thirty years. The population, in 1863 about 45,000, had risen to 64,000 in 1879 and to 114,000 in 1889, while in 1895 it amounted to 128,000. This figure is probably less than the real number, and even if the increase due to the refugees from Crete and Thessaly be neglected, the present population is calculated at not less than 140,000. Piræus has made similar progress, its inhabitants, who numbered five or six thousand thirty years ago, amounting to 51,000 in 1895. The two towns have now an aggregate population equal in number to that they are supposed to have contained in the fourth century B.C.—*Rivista Geogr. Italiana*, January 1899.

Dr. Steffen started in November for an expedition to the far south of **Chile**. He intended to reconnoitre the fiords from the isthmus of Ofqui (46½° S. lat.) to the Baker islands (48° S.) in order to find the most important of the rivers flowing from the interior to the coast in this region. He will then ascend the largest of these rivers, which will probably drain the Lago Buenos Ayres or a more southern lake basin not yet explored. At about 47° 20′ S. lat. and 72° W. long. is a large lake draining to the west, called Cochrane, at an elevation of only 1000 feet above sea-level, and the great lake, San Martin, which on all existing maps is placed in the basin of the Chico river, but according to the latest information has an affluent

to the Pacific. When he has accomplished his present task, Dr. Steffen will have explored the whole region of the watershed from Nahuel-huapi lake to the Magellan straits, with the exception of the small tract between the river Senguerr and the Lago Buenos Ayres, and therefore will attend on the Chilian plenipotentiary as geographer and scientific expert at the arbitration conference in England.—*Geogr. Zeitschrift*, Jahrg. v. Heft 2.

NEW BOOKS.

The Long White Cloud (Ao Tea Roa). By WILLIAM PEMBER REEVES, Agent-General for New Zealand. London: Horace Marshall and Son, 1898. Pp. xiv + 430.

In this book the writer, without troubling himself much about strictly geographical matters, has set before himself the task of compiling a concise yet comprehensive history of New Zealand—not "an official advertisement, the sketch of a globe-trotting impressionist, nor yet an article manufactured to order by some honest but untravelled maker of books"; and we are free to admit that he has more than fulfilled his task. The first chapters contain a well-written and often eloquent description of the country itself, and of its inhabitants, the Maoris. Then comes a brief account of the early navigators, *e.g.* Tasman, Cook, de Surville, etc., followed by missionaries headed by Samuel Marsden, whom the writer justly calls the Augustine of New Zealand. Then comes a graphic description of bloody intertribal wars and conflicts of the Maoris with the white settlers, the latter unduly prolonged by the disastrous policy of the home Government, which for many years was more than reluctant to declare New Zealand a part of the Empire, and refused to help the settlers against the Maoris. Then we have a good account of the pacification of the islands and of an unusually rapid development of constitutionalism, much of it of an ultra-democratic type. In this respect the history of the colony is deserving of very careful attention from those who favour, as well as those who distrust, what is now called Socialist legislation. In New Zealand the State is the largest landowner and receiver of rents, and the largest employer of labour. It owns nearly all the railways as well as the telegraphs and telephones. It controls and supports hospitals and lunatic asylums. It is the largest trustee, manages the largest life insurance business, does nearly all the conveyancing, and educates more than nine-tenths of the children. Here also the franchise has been extended to women, and voting by letter is allowed in the case of seamen and shearers of sheep. Legislation with regard to education, factories, mines, trades-unions, and social questions generally is far ahead of that of the mother country, and according to some it is considerably in advance of the practical needs of the colony. But the New Zealanders are very confident of themselves and their institutions, and have no fears for the future. The writer of this book, who is responsible to some extent for this legislation, repudiates the suggestion that there is in the colony any Socialist party of an extreme type. The reforms are declared to be by no means the monopoly of one political party, but are based on the principle "that a young democratic country, still almost free from extremes of wealth and poverty, from class hatreds and fears and the barriers these create, supplies an unequalled field for safe and rational experiment in the hope of preventing and shutting out some of the worst social evils and miseries which afflict great nations alike in the old world and the new."

Enough has been said to indicate the interest and gravity of the contents of this book. It remains to add that the author, although in no way concealing his personal predilections, renders fair play to those who differ from him, and writes with the ease and assurance of one who has studied on the spot and mastered the subject he deals with.

Le Dernier Rapport d'un Européen sur Ghât et les Touareg de l'Aïr (Journal de Voyage d'Erwin de Bary, 1876-1877). Traduit et annoté par Henri Schirmer, Professeur de Géographie à l'Université de Lyon. Paris: Librairie Fischbacher, 1898. Pp. 224.

M. Schirmer is well known in the geographical world by his admirable work *Le Sahara*, a review of which appeared in vol. x. p. 387 of this *Magazine*, and by his contributions to the *Annales de Géographie*. He has deemed it well to make Von Bary's reports, journals, and letters rather more accessible to his own countrymen than in the learned recesses of German periodicals. His translation has appeared very opportunely when a French mission is making its way to Aïr by way of Asiu, and his annotations, which supplement and correct Von Bary, greatly enhance its value and utility. In this latter work M. Schirmer seems to have collated all accessible reports on a geographical field in which he is a specialist.

Erwin von Bary, according to the biographic notice, was born in 1846. He studied the natural sciences at the universities of Leipzig and Zurich, and then at Munich, where he graduated in medicine in 1869. He had already been occupied with the study of Barth and Duveyrier, and had learned Arabic and the northern Tarki dialect. In 1873 he settled in Malta as a medical man, mainly in order to become acquainted with the customs of Tripoli and Fezzan. In 1875 he visited the district of Gharian; in the following year he set out for Ghat with the caravan of a Tripoli merchant, and arrived there on the 10th of October 1876. Thwarted in his desire to explore the Ahaggar territory, he set out for Aïr on the 5th of January 1877, and arrived there on the 8th of February. He resided first at Ajiro on a *contrefort* of Mt. Baghzen, and then at Tintaghode, at the foot of the Timge chain. On the 4th of September he set out on his return to Ghat, where he arrived on the 3rd of October. The next morning he was found dead.

According to Von Bary, the territory of the Kel-Owi extends from Ashagur (Achagour) in the east to Engishan (Enguichan) in the west. The great event in the life of the Kel-Owi is the *Aïri*, or annual salt caravan of Aïr, which has been described by Richardson and Barth. Von Bary gives the route from Aïr to Bilma; it is a march of five days across a *hamada*, destitute of water and fodder, to Ashagur, whence it is two days to Bilma. No part of the route is inhabited. From Bilma the caravan proceeds to Agades (by way of Agram, probably, which is Barth's itinerary), where it meets the Kel-Geres and exchanges the salt for Sudan goods. One of the most interesting of Von Bary's hearsay reports confirms that of Duveyrier as to an ancient route leading directly from Jerma to Aïr by way of Anai, which Duveyrier believed from the reported rock inscriptions to be the *carrossable* route of the Roman army from Garama to Agisymba. This is one of the problems in the ancient geography of Africa which remains to be solved.

In his introductory note M. Schirmer appreciates the sincerely scientific spirit of Von Bary, who had no political or commercial pre-occupations to affect his judgment. We cannot quite say the same of M. Schirmer, professor as he is, in his work of annotation, where he shows himself keen to minimise the evidence of Hausa influence. M. Schirmer has omitted some passages as of no great importance, but a doubt remains in the mind regarding these omissions.

There are three appendices, giving a Note by Von Bary on the geology of the Ghat region, a second on the desert characteristics of Aïr, and a third his meteorological register.

M. Schirmer has added an index to the botany and zoology, and another of the proper names, which last, however, is not, as we have found, complete.

It is much to be regretted that M. Schirmer or the publisher has not provided the book with a map, say, a section of Lannoy de Bissy's. The book is well worth it.

Schantung und seine Eingangspforte Kiautschou. Von Ferdinand Freiherr von Richthofen. Berlin: D. Reimer, 1898. Pp. 324. *Price* 10 *marks.*

Nearly thirty years ago the author visited the Chinese province of Schantung, and indicated Kiautschou as an excellent maritime terminus for railways from every point of north-east China. Now he sees his countrymen in possession of the seaport he valued so highly, and in this volume describes the province of Schantung, of which Kiautschou is a German, and Wei-hai-wei is a British, harbour. The work is illustrated with views from photographs, and is accompanied by an atlas of topographical and geological maps of Schantung, and also a map showing the railways made, in progress, or projected in north-east China. Whilst the author is of opinion that Kiautschou must mainly hope to benefit by railway connection with the interior, and by the industries in iron carried on there, he points out that the British occupation of Wei-hai-wei immensely strengthens the position of the Anglo-Italian syndicate, called the "Pekin Syndicate," which has obtained a sixty years' lease of the minerals of the Chinese province of Schansi, "a gigantic concession, which includes not merely the province of Schansi, but also part of the neighbouring province of Honan, with the mines of Hwaikingfu, and the exclusive right to construct railways in Schansi."

Schantung und Kiau-tschou. Von Friedrich Hirth. From the *Allgemeine Zeitung.* Munich, 1898.

In this pamphlet F. von Richthofen's work *supra* is sharply criticised, his ignorance of Chinese is pointed out, and his statement that Shantung is not a poor province is combated.

Among the Celestials. A Narrative of Travels in Manchuria, across the Gobi Desert, through the Himalayas to India. By Captain Francis Younghusband, C.I.E. London: John Murray, 1898. Pp. 261.

Now that China is the subject of so much discussion, Captain Younghusband has thought good to publish in a compact form an account of his travels to the Long White Mountain in the company of Mr. James, and of his long journey across the Chinese Empire. These chapters are condensed from the author's *The Heart of a Continent,* many of the details chiefly of interest to the professed geographer and traveller being omitted. A few remarks are added upon the present state of affairs in the East. The author does not believe in the policy of bolstering up the effete Chinese Government, but holds that active steps should be taken to maintain freedom of commerce, in which other European powers, Russia excluded, are also interested, and therefore he fully approves of such measures as the occupation of Wei-hai-wei.

Edward Gibbon Wakefield: the Colonisation of South Australia and New Zealand. By A. Garnett, C.B., LL.D. London: T. Fisher Unwin, 1898. Pp. 386. *Price 5s.*

Many of our readers, we suppose, know a good deal about the present constitution of the colonies of Australia and New Zealand, but only a few, we fear, are acquainted with the origin of constitutionalism in South Australia and New Zealand, or how much these colonies are indebted to Edward Gibbon Wakefield for their present political systems. The truth is that his name, although well known in the first half of the century in colonial and parliamentary, and to some extent in literary, circles, was but little before the general public. Unfortunately for himself and for the country, a youthful escapade—viz., the abduction of Miss Turner, in expiation of which he spent three years in Newgate—was a permanent barrier to his ever obtaining public employment under any Government, and whatever he attempted or effected he had to do as a wirepuller and through the agency of others. Three years in Newgate at any time, and certainly three years beginning in the twenty-fourth year of one's life, would sober any man, even one whom Dr. Garnett describes as "a young man of fashion, a buck in his attire, of wild and almost insolent spirits, ready for any frolic, and not discriminating too nicely between frolic and mischief." During these three years he had perforce to turn his mind to other things, one of which was criminal reform; and to his experience in Newgate we owe his powerful work on *The Punishment of Death*, which contributed not a little to the repeal of the sanguinary laws which at that time disgraced the statute-book. An important branch of the general question of criminal reform was the position of the colonies, to which convicts sentenced to transportation were sent. Most probably the consideration of this incidental issue directed Wakefield's attention to the whole question of the then system of colonisation; and it was not long before he came to the conclusion that it was essentially and radically bad. In pondering how to remedy the clamant evils, he set forth new principles, the enunciation of which is now recognised as having heralded a revolution in the history of British colonisation in general, and in the history of our Australian and New Zealand colonies in particular. The original system in these colonies was this: land was granted free of price to all who applied for it, or was allowed to be appropriated to any extent by any one who chose to do so; and in this way immense tracts had actually, though often nominally, fallen into the hands of individuals who found it impossible to work them. Thus, much of the best colonial lands remained unbroken up, and when new emigrants did arrive, they had either to accept the status of hired labourers or to go away into the interior, where alone they could find unappropriated land. The cardinal principles of the Wakefield system are: that no land should ever be granted free of price, and that all land should be taxed and a proportion of the land revenue so raised should be constituted a fund for the importation of emigrants free of cost. These principles seem to us very simple and commonplace now, but when first promulgated they met with stout resistance both from the authorities at home and the colonists abroad. The story of the life of Wakefield is the story of how these principles were placed before the public and their approval secured. The battle was fought at home more than in the colonies, and was an uphill struggle, in which, although Wakefield's name, owing to his previous history, was but little heard, he really had to do most of the fighting. Wakefield also urged the necessity of ascertaining the needs of the colonies, and supplying only such labour as was wanted; he insisted on the despatch of only young emigrants, and on maintaining as far as possible an equilibrium between the sexes.

It was not in South Australia and New Zealand alone that Wakefield exercised a great and beneficent influence. He was the trusted and wise adviser of Lord Durham, when that nobleman in 1838 went to Canada, when the province was on the eve of rebellion. Lord Durham's famous report was the foundation of the new and generous policy by which Canada has become one of the most contented and prosperous of our colonies, and Wakefield's share in it was commonly stated in the epigram: "Wakefield thought it, Buller wrote it, and Durham signed it." But probably, as usual, the epigram is unjust—in this instance both to Buller and Lord Durham. Dr. Garnett has done his work well, and this volume will be very acceptable to the ever-expanding circle of people who are interested in the growth and prosperity of our colonies.

Canada. ("Romance of Colonisation Series.") By S. Barnett Smith. London: S. W. Partridge and Co., 1898. Pp. 320. *Price* 2*s.* 6*d.*

This is the fourth volume of the "Romance of Colonisation Series," and the third from the pen of the editor. It falls far more truly within the title of the series than did the volume on India, for it would be difficult to find a better illustration of the romance of colonisation than is afforded by the history of Canada. The author carries us through his recital at a brisk pace, and gives an excellent and well-proportioned general view of his subject. The latter part of the work is specially well done, and brings together in simple form the salient points of the recent history of the country. For those who have not previously acquainted themselves with the subject, it must come as a surprise to learn how many and severe have been the trials, internal and external, of the colony, and how recent is the peace which now promises to bring with it the prosperity due to the natural richness of the country and the enterprise of its people. In perusing the volume we have been struck by the extent to which Mr. Barnett Smith makes use of quotations. Some of these are from sources which are indicated, but many pages—a material portion of the volume, in fact—are without any acknowledged parent. Is Mr. Smith exacting a double duty from his own offspring? There is one point in which the book calls for serious protest, and that is the want of an index. To omit such a simple and necessary aid surely indicates that the work is not expected to obtain more than a single perusal. It is not offered as a work for reference. The author might have been expected to take a higher view of the result of his own labours.

Early Israel and the Surrounding Nations. By the Rev. A. H. Sayce. London: Service and Paton, 1899. Pp. xxvii + 387. *Price* 6*s.*

The Oxford Professor of Assyriology is a voluminous, and somewhat of a controversial, author. Avoiding polemics, Dr. Sayce has, in this popular little work, gathered up the results of his studies and research. He passes under review "some of the facts which have been won by modern discovery from the monuments of the nation who helped to create the history of Israel," to use his own words. He shows the Jew to be by no means pure in race. Beginning as a mixture of Israelite and Edomite, he was further mingled with Moabite and Philistine elements. The Jew owes his chronic ascendency to religion and history, not to purity of race. Abraham was a native of Babylonia, and the influence of that greatest of early world-powers is proved to have been overwhelming alike in the Mosaic laws, the institution and name of the Sabbath, the festivals, and the year of Jubilee. The inscriptions show, further, the immense age and culture of civilisation in the East. "So far as archæology can teach us, the builders of the

Babylonian cities, the inventors of the cuneiform characters, had behind them no barbarous past." The nineteenth century closes with the discovery of brick libraries in Chaldæa, and papyri in Egypt. The Frenchman de Sarzec unearthed 30,000 tablets at Tello, in southern Chaldæa, formed when Gudea ruled over the city in B.C. 2700, and arranged in shelves one above another. At Niffer, in north Babylonia, the Americans have just found a larger number which go back six thousand years, to Sargon of Akkad. The Arabs are now pouring in to the museums of the West other clay-books found at Borsippa and Babylon, at Sippara and Larsa. Amraphel of Babylonia was a contemporary of Abraham, and we now know Babylonia as well as the Athens of Perikles. Yet Amraphel marks the decline of a civilisation which had reached its height in the epoch of Sargon and Naram-Sin, his son, two thousand years before. Then the Babylonian system of writing, and of a postal service which embraced all the cities and high roads, took its final form. It is a pity that Dr. Sayce has not supplied a map of Asia in these times—Semitic-Babylonian and Israelitish.

Korean Sketches. By Rev. JAMES S. GALE, B.A. (Toronto). Edinburgh and London: Oliphant, Anderson, and Ferrier, 1898. Pp. 256. *Price* 3*s.* 6*d.*

Mr. Gale has given us, in a series of racily written chapters, a lively picture of Korea as it is, and of the Koreans as they are and have been since "the long forgotten days before our Anglo-Saxon race came into existence." After nine years' life among such a people, an alert-minded missionary with strong human sympathies could hardly fail to have something worth telling to the world; and perhaps of special interest in this respect are Chapters II., VII., IX., and X., devoted respectively to the delineation of the Korean Coolie, the Korean "Boy," the Korean Mind, and the Korean Gentleman. In addition to the familiar habits of mind and body which we call Oriental, the Korean has others peculiar to himself; and these are well brought out in the pages before us. Reminiscences and personal experiences bulk largely in nearly all the chapters; but the author is a *raconteur* of no mean order, and tells his stories to purpose. Some interesting glimpses are given of the recent war between China and Japan in the chapter headed "The Yulu and Beyond," and again in Chapter XI. on Korea's Present Condition. Mr. Gale has apparently no liking for the Japanese, but highly commends their general conduct throughout the campaign. The murder of the Korean Queen was, however, an ugly affair, distinctly discreditable to all who had to do with it. The present bankrupt condition of Korea is fitly described; and, on the principle that a worse condition could hardly be imagined, the author looks for a financial change which must of necessity be for the better. The second last chapter deals with some special friends, of whom the quaintest was Kang, nicknamed Don Quixote, the owner of a very small steamer, with which he said he had visited "Sang Prisko." The book ends with a missionary chapter, in which graceful tributes are paid to four pioneer missionaries, who succumbed one after the other to the evil climatic influences of the country. Some eighteen illustrations add to the interest of the book; and the value of it would have been enhanced had the author included a map of the country, with special reference to his own journeys.

An Intermediate Text-Book of Geology. By Professor C. LAPWORTH, F.R.S., etc. Edinburgh and London: Blackwood and Sons, 1899. Pp. 414.

This work, founded upon the late Professor Page's *Introductory Text-Book of Geology*, addresses itself to two classes of students, being intended to meet not

only the wants of beginners, but of those who desire to go beyond the merely elementary stage. The sequence of subjects adopted is that followed in Page's *Introductory Text-Book*, but only a few paragraphs of the original work remain. Professor Lapworth's volume is therefore an essentially new treatise. It is well written—the explanations being lucid and to the point; while the information is brought quite up to date. Authors of text-books and teachers of science have each their own methods of presenting their subject, and we need not object to Professor Lapworth's volume that considerably more than one-half is devoted to Historical Geology—*i.e.* to the final results of geological investigation. Most text-books, large and small alike, are similarly constructed. Yet we cannot help thinking, that for introductory and intermediate manuals this is a mistake. In the earlier stages of his work it is more essential that the student should be well grounded in dynamical and especially in structural geology, petrography, and elementary palæontology, than in historical geology. His chief aim should be to acquire a knowledge of the principles and methods of geological investigation. A short outline of the results obtained in stratigraphical or historical geology is all that is required by beginners. But while that is our view, it is obviously not that which prevails amongst writers of text-books, otherwise they would devote less space to historical geology and treat the other subjects more fully. Compared, therefore, with other works of similar range and extent, we have no hesitation in saying that Professor Lapworth's treatise holds its own, and will, doubtless, be well received by teachers. It is, as we have said, admirably written and well furnished with excellent illustrations.

The Principles of Stratigraphical Geology. By J. E. Marr, M.A., F.R.S. Cambridge: The University Press, 1898. 8vo. Pp. 304. *Price* 6*s.*

This volume forms one of the useful series of Cambridge Natural Science Manuals, and has been written, its author tells us, "in order that students may gain by its perusal some idea of the method and scope of Stratigraphical Geology." He believes "that this idea can be obtained most satisfactorily if a large number of the details connected with the study of the stratified rocks are omitted." He has accordingly given very brief accounts of the strata of the different geological systems, his book being intended for use in conjunction with any treatise in which Historical Geology is considered in more or less detail. The work therefore addresses itself apparently to readers who have got beyond the elementary stage, and may now be considered "intermediate" or "advanced" students. A book written as a supplement to other books dealing with the same subject may be highly useful, but is not likely to be in itself very readable or entertaining. Mr. Marr's work, therefore, does not appeal to readers who have not already made some progress in geology—the "general reader" would, we fear, find it rather dreary. But the ardent student will obtain from its pages many hints to help him on his path, and not a few warnings against the pitfalls into which the unwary now and again fall. But in this book, as in Professor Lapworth's, noticed above, rather more than half the work is devoted to descriptions of the several geological systems—that is to say, to the general results of geological investigation into the history of the past. Had Mr. Marr devoted considerably more space to the structural geology of the stratified rocks, which, as a qualified specialist, he could readily have done, his book, we believe, would have been more highly appreciated by those to whom it is addressed. The latter and bulkier portion of his work can be appreciated only by geologists who have got beyond the need of elementary text-books, and are capable both of observing for themselves and of criticising the observations made by others.

The Story of Geographical Discovery. How the World became known. By JOSEPH JACOBS. London: George Newnes, 1899. Pp. 224. *Price* 1*s.*

To compress the history of discovery into 224 duodecimo pages is a task that most writers would shrink from. Yet it must be confessed that Mr. Jacobs has been remarkably successful in describing at least the main lines, and has shown great judgment in selecting his facts. He has also added an appendix containing the "Annals of Discovery" in chronological order, and the names of the chief explorers arranged under the respective countries. Omissions and inaccuracies seem to be very rare; the omission of all mention of the Teleki expedition could not be objected to in a work of this size, were not the entry inserted, "1896, Donaldson Smith traces Lake Rudolph." Again Torres was not the first European to see the Australian coast, for the *Duyfken* entered the Gulf of Carpentaria several months earlier. It is also more than doubtful whether the Seres were identical with the Sinæ, as Mr. Jacobs takes for granted.

A Statistical Account of the Seven Colonies of Australasia, 1897-8. By T. A. COGHLAN, Government Statistician of New South Wales. Sydney: W. A. Gullick, 1898. Pp. 543.

This work has somewhat increased since the earlier issues, and now contains a valuable collection of comparative statistics relating to the people and industries of the colonies, besides other interesting and useful matter. In the latter may be included the chapter on federation, which has advanced a step further since the book was compiled, and is now on a fair way to realisation. To the tables of mortality are added "indexes of mortality" according to the plan suggested by the International Statistical Institute in its 1895 session. The population of Sweden in 1890 is taken as a standard, and is divided into five age-groups, of which the percentages are obtained. On this basis indexes of the mortality in the Australian colonies are calculated, which indicate the comparative vitality much more accurately than death rates.

The Story of the West Indies. By ARTHUR KENNEDY, M.A. ("Story of the Empire Series.") London: Horace Marshall and Son, N.D. Pp. 154. *Price* 1*s.* 6*d.*

These little books contain useful summaries of the history of the countries they treat of, with some account of their present state. The volume on the West Indies is well arranged, and contains all the principal events in the history of the British West Indies, British Guiana, and British Honduras. A chapter at the end deals with the present crisis in the sugar industry, giving the opinions of the Royal Commissioners sent out in 1897, and approving of Sir Henry Norman's proposal to levy a "duty on bounties."

Vasco da Gama und die Entdeckung des Seewegs nach Ostindien. Auf Grund neuer Quellenuntersuchungen dargestellt. Von Dr. FRANZ HÜMMERICH. Munich: Berc, 1898. Pp. 303. *Price* 5 *marks.*

The author says that, whilst Germany possesses no really scientific work on Vasco da Gama, the Portuguese work of J. M. Latino Coelho (1882), and the English one of H. E. J. Stanley (1869), are unsatisfactory. He states that he has discovered new material regarding Vasco da Gama's second journey to India, enabling him, he hopes, to present in this volume a critically correct biography, which is accompanied by an excellent photogravure of a portrait of the great traveller, painted during his lifetime, and hanging in the Academy of Fine Arts at Lisbon.

NEW MAPS.

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CENTRAL AND SOUTH AFRICA. Scale 1 : 5,600,000.
J. Bartholomew and Co., Edinburgh.

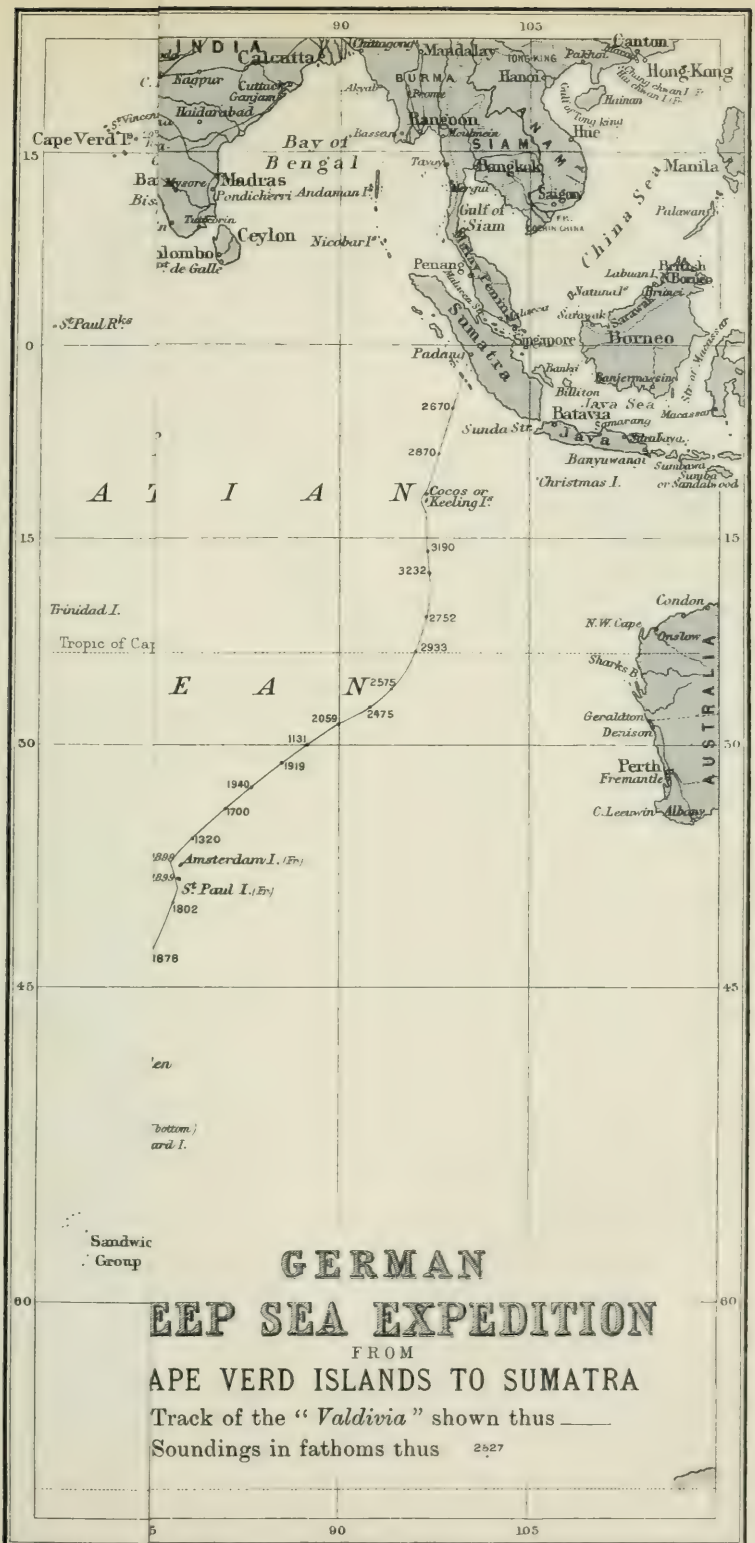
ATLAS.

L'ANNÉE CARTOGRAPHIQUE. Supplément Annuel à toutes les Publications de Géographie et de Cartographie, dressé et rédigé sous la direction de F. Schrader. *Prix 3 francs.* *Librairie Hachette et Cie, Paris,* 1898.

The new issue contains three sheets of maps, dealing with Asia, Africa, and America respectively. As usual, the information is full and accurate up to the date given, *i.e.* 1897. One wonders, however, why the new boundary of the Niger territory is not included, and why the northern boundary of the Gold Coast territory is drawn entirely along the 11th parallel. Good maps are given of the Andes from about 40° to 60° S. and of Dr. O. Nordenskiöld's explorations farther south. Since 1897 there have been new expeditions in the former region.

B. KOZENNS GEOGRAPHISCHER ATLAS FÜR MITTELSCHULEN. Vollständig neu bearbeitet von V. v. Haardt und W. Schmidt. Wien, Hölzel. *Price Fl.* 3.50, *bound Fl.* 3.80.

This ranks among the better class of atlases used by German pupils in secondary schools. It is characterised by a careful selection of the maps, of scales, of contours and of the matter to be shown in these maps, which of course are not simply old plates from a general atlas with a few names scraped out. Mathematical geography is more fully illustrated than is customary in such an atlas, and Dr. Schmidt contributes the text which explains the figures he has chosen. The sheet showing pictures and maps of typical landscapes is a useful one, but the necessity for using the map tints for the landscapes has spoilt their colour effect. The maps, too, should have been arranged so that their north and south or east and west corresponded with those of the pictures. The temperature maps are rather crowded. Special attention is paid to the Alps and to Austria-Hungary. One very beautiful physical map showing the Austrian Alps deserves special commendation for its workmanship and for the absence of all names, and the use of only small initial capitals for the highest mountains. The use of such names as *Mercia*, *Westsex*, *Ostangeln*, and *Northumberland* stretching south to York, on the map of the British Isles is misleading, and should be reserved for a historical atlas. It is not customary in this country to call the north-western Highlands the Caledonian mountains.



GERMAN DEEP SEA EXPEDITION

FROM

CAPE VERD ISLANDS TO SUMATRA

Track of the "*Valdivia*" shown thus ——

Soundings in fathoms thus 2827

The Edinburgh Geographical

The Edinburgh Geographical Institute

Scottish Geographical Magazine, 1899

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

THE CAROLINE ISLANDS.

By F. W. Christian.

(*Read before the Society in Edinburgh on February 14th.*)

Introduction.

A good many years ago I took a schoolboy's fancy to visit the islands of the Pacific, one of the pardonable ambitions of youth which it is so rarely given to us to realise. I will tell you first how I came to hear of the Carolines, how I got there, how I fared there, and what I did there, and will then go on to describe the geographical situation of the archipelago and something of its history and products. Then I will give you some views representing the beautiful scenery of these islands, and some types of the folk who inhabit them. I will also bring up on the canvas before you some views of an enchanted region of archæology—views of some massive and wonderful works in stone found in a remote province of a remote island in the Eastern Carolines. This place is known to geographers as Ponape, the Land of the Holy Places. Lastly, I will show you some scenes from the Yap and the Pelew islands, which lie some fourteen hundred miles nearer Manila, on the western edge of this extensive archipelago, which seems bound sooner or later to fall out of the paralysed hands of Spain into the firm grasp of America, or the itching palm of energetic Japan, or into the grip of the Emperor of Germany, whose final answer, to use his own words, to a barbarian enemy is a crushing blow of the mailed fist.

About fourteen years ago, when I was a schoolboy at Eton, I heard first of the Caroline islands and some remarkable ruins in the east of the group. After leaving Oxford in 1889 I was so fortunate as to have an opportunity of visiting Sydney in New South Wales, and the

city of Wellington in New Zealand, which I made alternately the centres of my expeditions into the Pacific. I spent six years exploring in Samoa, Tahiti, and the Marquesas in the South-Western and Central Pacific, during which time I carefully studied the local dialects and fairy tales. In 1892 I witnessed Mataafa's revolt in Samoa. There I met R. L. Stevenson the author, kindliest and most genial of hosts and the best of neighbours, who, when I left the island, bought my plantation. On my return to Sydney, in the middle of 1895, I met Louis Beck, the well-known writer of South Sea Island tales. I heard what Stevenson and Beck alike told me, of acres of unexplored ruins, numbers of strange, unchronicled dialects, and a whole volume of native folklore waiting for a historian. To use the words of Rudyard Kipling, "I heard the east a-calling," and I went. The two first stages of my journey to the Carolines were a month's steaming northward from Sydney to Hong-Kong, and a week's stormy passage from Hong-Kong by way of Amoy to Manila. Thanks to the kind offices of Sir William Robinson, our Governor at Hong-Kong, and Sir Stewart Lockhart, the Colonial Secretary, General Blanco, the Spanish Governor of the Philippines, gave me letters to his subordinates upon Yap and Ponape, the two military stations in the West and East Carolines. This was while the Filipino rebellion lay dormant, and before the red and yellow flag of Spain went down for ever before the stars and stripes on that eventful morning in Manila bay.

From Manila to Yap, the westernmost of the Carolines, was a run of some 1200 miles by the monthly mail steamer. Yap I reached on December the 21st, 1895. On Christmas eve we dropped anchor off the beautiful island of Guam, in the Mariannes, and reached our easternmost goal, Ascension Bay on the island of Ponape, on New Year's day of 1896. In this neighbourhood, thanks to the aid of the Spanish Governor and some of the district chiefs, the Manila photographer whom I had engaged was able to take many photographs of the island scenery and the people. We paid a visit to some remarkable ruins in the Metalanim district on the east coast. Our explorations in this, the most interesting of all the districts, were attended with considerable risk, the natives, thanks to the slack rule of the Spanish, nursing a deep hostility to all white men. A morose district chief finally put an end to our work just as our excavations were bearing good fruit. We carried away, however, a great number of curious relics.

After leaving Metalanim I returned to the Spanish colony, where my Manila photographer left me. He returned to Manila, joined in the rebellion, which had just broken out, and was taken prisoner in a skirmish. A court-martial was held, and one morning the Spaniards shot him on the Water Front with about forty other disturbers of order. For my part I stayed on, grammar and dictionary-making, and collecting marine specimens amongst the Ponapean savages. I found them on the whole pleasant and amiable people. Towards the end of the year I went back in the Spanish mail steamer *Uranus* to Yap, where I took many sketches and notes. I returned to Hong-Kong in a small trading vessel in the New Year of 1897.

I wish I could have introduced to you to-night my Manila man, whose photographs you will see presently on the canvas; but my poor man Friday, like all the other Filipinos, would not take good advice, ran out of safety into danger, and threw his life away. I may here remark, knowing well what manner of men these Filipinos are, that the present native rising in Manila is not a cause of pure patriotism. It is directed by unprincipled men working for their own selfish ends against law and order. It means treacherous assault, the surprise and sacking of small, undefended towns. It means the massacre of peaceful Europeans, and the torture of helpless women and children. It also means firing on the Red Cross of Mercy and the White Flag of Peace. Therefore I cannot ask your sympathy for my Manila man or his compatriots recently slain by the Spanish and by the Americans in the Philippines. I would rather bid you rejoice with me that some law and order is possible in these benighted regions. Law and order the Americans mean to have, and it has got to come, or good-bye to Manila hemp and Manila tobacco. I will now pass on and give you an account of Spain's outlying possessions in the North Pacific, the last remnants of her once magnificent Colonial Empire.

Spanish Micronesia.

Spanish Micronesia, according to the treaty made with Germany in 1885, lies between the Equatorial line on the south and the eleventh northern parallel, and between 139° and 170° E. longitude. The great island of New Guinea lies about 1000 miles to the southward. A long chain of 652 islands lie scattered over this wide stretch of sea, some 1400 miles in length. The inhabitants number some 50,000, a combination of the Black, the Brown, and the Yellow races. The Caroline archipelago contains thirty-six minor groups. We will take the more important of these one by one from west to east.

The Pelew group, lying on the western frontier of the Carolines, contains about two hundred islands, of which Babelthoab is the largest. The population of the Pelews is considerably over 3000. The language is the harshest and most impossible of all the Malayan dialects. The principal products are turtle-shell, copra or dried cocoanut kernel, and bêche-de-mer or dried sea-slugs. In the Chinese markets bêche-de-mer brings as much as £80 sterling per ton. Copra in European markets fetches about £25 per ton. It yields a capital oil, and the crushed residue furnishes a grand cattle-cake and is used as a basis for sweetmeats and confectionery.

Trouble is always going on between the various tribes, and a firm hand is needed to keep things in order. Captain Butron of the Spanish cruiser *Vellesco*, lost in the late naval battle at Manila, who visited the group in 1885, gives these natives a good name. Captain O'Keefe, of Yap, who knows the Pelews very well, describes the people as regular pirates. In olden time there was great commercial activity in the Western Carolines. The Yap and Pelew natives used to go on long voyages of trading and conquest. The island of Babelthoab is rich in good timber,

and produces all the tropical fruits. On the hill-side are some interesting lines of ancient fortifications, which I hope to explore next winter.

Alligators, called *Gaiutsch* or *Aius*, are found in some of the creeks, and a peculiar kind of horned frog or *Cerastes* in the valleys of the interior; this they call *Thagathaguk*. There are two kinds of snakes, *Bersoiok*, some scorpions and centipedes. On the plateaus there is plenty of good pasture for horses and cattle. Goats are plentiful and very destructive to the breadfruit-trees; they break into a plantation, gnaw the bark away in a circle, and then the tree dies—so does the goat when he is caught! There is no Spanish garrison or mission school or trading station in the Pelews. Nothing is done at all to show that these islands belong to Spain. A fringing reef, fifty-three miles long from north to south, surrounds the Pelews—a menace to navigation which has destroyed many a China-bound vessel. I have lately heard that the Spaniards are now determined to sell the Pelews, the Mariannes, and the Carolines to some foreign Power, but neither America, Great Britain, nor Japan need apply—and these the very nations best of all qualified for colonising these fierce and intractable islanders. In her business relations in Pacific islands, Great Britain would do well to take heed of the saying of Horace, "Tarde venientibus ossa"—"Those who come late to dinner only get bones."

Three hundred miles north-east of the Pelews lies Yap, surrounded by a coral reef thirty-five miles long and five broad. There are hardly any rivulets on the island, but inland are extensive swamps laid out in plantations of a water taro, the *Colocasia* of the Nile valley. The island is full of relics of a vanished civilisation—embankments and terraces, sites of ancient cultivation, and solid roads neatly paved with regular stone blocks, ancient stone platforms and graves and enormous council lodges of quaint design, with high gables and lofty carved pillars. The ruins of ancient stone fish-weirs fill the lagoon between the reef and the shore, making navigation a most difficult matter, and calling forth many most unkind remarks from trading skippers. The fruits of the soil are sweet potatoes, yams, of which there is a great variety, taro, mammee apples or papaw, pineapples, water-melons, custard-apples, bananas, sugar-cane, breadfruit, and the tropical almond. Copra, that is, cocoanut kernel chipped up, sun-dried, and put into sacks, is largely exported, mostly through the German traders, who have spent a great deal of money and labour here for the last thirty years. A varnish nut grows here which should give good results. The principal timber tree is the *Voi*, with a leaf like that of a magnolia and in the wood resembling mahogany. Tomil harbour is the chief port; here is the European settlement and a small garrison of Manila soldiers, and the Spanish governor of the Western Carolines resides here with a few Spanish officers and officials. There are about a dozen European traders, mostly Germans.

Yap has beautiful scenery; the groves of bamboo, croton, cocoanut and areca palms are very fine indeed. Huge green and yellow tree-lizards, called *Galúf*, are found in the bush, and the nights are brilliant with fireflies glittering in and out of the woods like showers of golden

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sparks. There are very few birds, however, very few cattle, and no horses on the island.

The Uluthi or Mackenzie group lies a little to the northward of Yap. Mokmok or Arrowroot island is the chief port and trading place, with a great trade in copra. The natives have from ancient times been subject to Yap, and they come down every February to pay their tribute. They are peaceful and law-abiding, a great contrast to some of the people farther to the eastward. The next island of importance is Uleai. Raur is the trading depôt of this group, exporting great quantities of copra, pearl-shell, and bêche-de-mer. The language contains many traces of later Malayan, probably derived from trading vessels from Java and piratical praus from Borneo and the Sulus. All the central Caroline islanders have very similar traditions, customs, and language. In olden days they were great navigators, guiding their way fearlessly by a most accurate knowledge of the stars and ocean currents. When the Spaniards conquered the Mariannes about three hundred years ago, a great number of the Chamorro or natives of the soil fled to Uleai and Lamotrek to avoid forced conversion and slavery. I will give an instance of the great naval enterprise about the beginning of this century of the natives in this part of the Carolines. The Uleai folk and their neighbours used regularly to assemble at Lamotrek every February with eighteen or twenty great canoes. From thence they sailed to Guam, a distance of some five hundred miles, where they would stay until April or May and then return, fearing the south-west monsoon.

The two next Caroline groups, Hall and Enderby, are only to be visited with great precaution. The islands Pulo-Wat and Pulo-Suk are nothing better than pirate strongholds. It would be well for an English or American man-of-war to visit here, and warn the local chiefs against cutting off peaceful trading vessels in their lagoon. They have no respect at all for the red and yellow flag, for the Spanish have taken little or no notice of several murders committed here of late years. The next group is called Ruk, from the name of the highest basaltic island in the chain. It is also called Hogolu. The group consists of about seventy islands of basalt and coral lying in the middle of a lagoon about 140 miles round. There is a fine depth of water and good anchorage for vessels of large draft. There is a great annual output of copra, mostly carried off to Europe in German or Norwegian barques. Pearl-shell, turtle-shell, and bêche-de-mer are very abundant. Here they make an orange-coloured cosmetic from the grated root of the wild ginger, which they make up into little cones which are readily exchanged all over the Caroline group. There are thirty Japanese traders in Hogolu lagoon, and a Hamburg trading firm sends many vessels every year to fill up with copra. Figures are sometimes better than photographs, so for those interested in statistics I will say that the annual export of copra from the Caroline group averages four million pounds weight, of which Yap and Hogolu between them yield more than half. Hogolu has a population of about 10,000, composed of two distinct races. The hill tribes are dark in colour and the people on the coast light reddish-brown. There is generally some small civil war on hand, and the national game of head-

hunting has interfered a great deal with business, for the Spanish let the islanders do just as they like. The natives of Ruk and of the neighbouring group of the Mortlocks have a curious custom, observed also in the Visayas of the southern Philippines, among the ancient Incas of Peru, and the Polynesians of Easter island, of piercing the lower lobe of the ear, loading it with heavy ornaments and causing it to hang downwards to an enormous size. The Mortlocks consist of three groups, Lukunor, Satoan, and Etal, containing in all ninety-eight islands. The population is about 2000. The Germans take great pains to develop the copra industry here. Of great interest to philologists is the account of a pure Polynesian dialect upon two little island groups named Kap-en-Mailang and Nukuoro. These lie to the south-east of the Mortlocks. The language is an antique form, combining the phonesis of the Samoan and the Maori, spoken about three thousand miles away down in the South Pacific. I collected about 500 words of the Nukuoro dialect, and shall be very happy after the lecture to answer any questions put to me by any one specially interested in this subject.

The island of Ponape occupies some 340 square miles. It is surrounded by an extensive reef, shutting in a wide lagoon studded with many small islands. The interior is occupied by hill-ranges running up to some 3000 feet. The face of the land is seamed by deep valleys and ravines worn by the rivers in their seaward course down through the belt of mangroves and cocoanut-palms that girdle the low-lands like a great green ribbon. The population of the island is about 5000, most of them living on the coast, for the natives have a superstitious dread of the densely wooded interior. As you will see, the island is divided up into five tribal districts, each under hereditary chiefs. The Metalanim tribe along the east coast is hostile to white men; the other tribes are generally friendly. On Ascension Bay in the north lies the little Spanish colony of Santiago, since destroyed in the rising of last October. The principal harbours are four in number. At Mutok, at the mouth of the Kiti river on the south coast, wood and water are easily obtained, provisions are cheap, and the natives honest and well disposed. About fifteen miles up to the westward is Ronkiti harbour, where a powerful district chief, Henry Nanapei, keeps his people well up to the mark. There are plenty of pigs and fowls, and vegetable and tropical fruits may easily be obtained by ships calling at the two western har-bours. On the other hand, vessels should give a wide berth to the two eastern harbours of Metalanim and Ponatik. The water-supply here is poor, provisions ridiculously dear, and the natives of the district notorious rogues and thieves. A little to the south of Metalanim harbour are the famous ruins. In 1890 the Spaniards lost a great number of lives in trying to capture the stockade of Ketam on the river at the head of the bay. Seeing what good results have followed on the west coast from the interest taken by the district chiefs in cultivation, it would seem a good and useful measure to distribute by Government grant packages of useful seeds to the more enlightened chiefs of the tribes. The chief products of Ponape are copra, bêche-de-mer, and ivory nuts, the last the fruit of the sago-palm, which grows some seventy feet in height. The

solid kernels are sent to Germany and made into buttons. The varnish nut is also found, which the Malayan races have known and used for many hundred years. The forests inland and salt marshes below are full of timber trees and wood useful for ornamental work. There are plenty of pigs and dogs, some of the latter tailless, and of an ugly, tawny tinge, much esteemed for food by the folk of Metalanim, greatly to the derision of their mirthful neighbours in the south-west. At Mutok there are goats, and in the Ronkiti valley Nanapei keeps some cattle. The rivers are full of fish like whitebait, and the pools swarm with large freshwater prawns. There are eels of a gigantic size, greatly dreaded by the natives, who will not eat their flesh. Small scorpions are found, and a centipede of which the natives have a holy horror. No frogs or snakes have yet been discovered. There are several sea snakes and sea eels, some with very beautiful rings, stripes, and markings. The sea is full of all manner of quaint, bizarre, and gorgeous forms of marine life. There are many vegetable treasures in the bush possessing valuable medicinal properties. These the old people know, but will not point them out to strangers. Nevertheless, I managed to note some curious facts; but it was very slow work. The pine-apple, mango, sugar-cane, and several sorts of banana and plantain, as well as yams and taro, grow abundantly. Breadfruit grows also in great luxuriance, especially on the upper coast.

Farther east from Ponape are the Mokil (or Duperrey), the Pingelap (or M'Caskill), and the Kusaie groups, the easternmost outpost of the Spanish dominions. In conclusion, I may express my opinion that England may one day have a great deal to do with the islands Kusaie and Ponape, the latter of which really deserves the name of the garden of Micronesia. I may be pardoned for saying that our Government at home has of late years shown itself somewhat indifferent to events in the South Seas. The French and the Germans are pushing their interests in Pacific waters, whilst we stand still. Even the Norwegians are busy there, and we look tamely on and do nothing. Let us wake from this strange torpor like men of business and try what we can do. Surely where French, Germans, and Norwegians can make money, we can make money too!

Now I will try and give you some idea of the beauties of the island of Ponape. Ponape is very rich in landscape effects. In the season of the rains, from the mountain ranges in her centre run down seaward many threads of hill water, which you may see sparkling and flashing far away up on the sides of grim black precipices lowering down upon the lowlands. But Nature is not all bare and rugged here. She has clothed the hill-slopes with a multitude of hanging woods, a perfect labyrinth of climbing fern and creeper barring the way to the untrodden silences within, domed by the shadow of mighty forest trees, waving overhead in the fresh and mighty breath of the trade wind, whilst from below comes up for ever the ceaseless boom of the unsleeping breakers. Through the green underwoods leap the mountain becks, twinkling and dimpling into shallow pools, lively with the silvery arrows of darting fish. There the king-fisher sees reflected for a moment his breast of buff and azure, and

is gone swifter than arrow into the blue of which he seems himself a bit. A waft, a delicate exhalation of fragrance, from the pandanus flower comes down upon the light breezes, sweet as a field of beans in blossom, through the mellow silence, as though some old god of the forest were breathing down a benediction upon the weary sons of men.

The lemon Hibiscus below weaves her tangle of leaf and root-spray, scattering earthwards her starry yellow blossoms with their centres of rich velvet-brown. Shoreward stretches the green ribbon of mangroves and timber trees, masking the salt marshes fed by the tons of alluvium borne down year after year by the mountain streams. Along the sand-spits stretches the belt of cocoanut-palms, their roots at high tide bathed in the rich salt water. Below, the clustering tendrils and the lilac and purple bells of a convolvulus mark the limit of the tidal rise.

To dimly show the beauties of forest, sky, air, and sunlit sea mere words are tedious and ineffectual. They hardly serve even to give a glimpse of nature in her happiest moods. Artists who wish to see what nature can do must quit this island of ours, of cloud, mist, and shadow, and view Nature's clear-cut handiwork in the far-off Tropic seas.

Bêche-de-Mer Fisheries on Ponape.

The bêche-de-mer is known to naturalists as the *Holothuria*. It very much resembles one of our large garden slugs, but is much longer and broader. These creatures are found in great numbers on the outer reef and upon the detached stacks of coral rising up near the surface of the lagoon. Others again are found in the reef pools, and others on the sandflats, or amongst the roots of the mangroves at the edge of the salt marshes. There are many varieties, but all are not of equal value. The kinds mostly valued for exportation are the *Shoe-Fish*, a thick, broad, grey species; the *Tiger-Fish*, which is olive green, with bright orange spots; and the *Teat-Fish*, which is black or greyish brown, and covered all over with odd little knobs and lumps. A fourth species, rather long, and of a dark red colour, is also used for curing.

The process of curing is as follows:—The sea-slugs are taken ashore, cut open, and cleaned. Then they are put into a huge iron pot and boiled for an hour or two. Then they are laid upon a framework of reed grass or fine cane. This is set up in the drying shed in the current of a continuous column of smoke coming up from a fire of drift-wood below, which is kept smouldering away both night and day. When thoroughly cured, they look just like lumps of leather. They are then put up into sacks, and shipped off to the markets of China and Japan. Prepared in a certain way, they form the basis of a splendid soup, much relished alike by Asiatic and European epicures in the East. It is equal to the finest turtle soup.

The Island City of Nan-Matal.

These ruins lie a little south of the entrance to Middle Harbour on the east coast, consisting of some sixty walled islets of rectangular form

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built up in the waters of a shallow lagoon. A number of canals, greatly choked with salt-water brush, intersect this Micronesian Venice. Hence its name, *Nan-Matal*, the place of the *matal* or waterways. An immensely solid double breakwater, some three miles in length, shuts out the deep waters of the outer lagoon. Upon this barrier in stormy weather beat tremendously heavy breakers. At these times the scene is wonderfully wild and grand. The walled islets and great breakwater are alike built up of massive and weighty blocks and prisms of black basalt. The enormous quantity of materials used by these early builders must weigh many thousands of tons. The stones were all brought down in rafts from the glens below the great cliffs of Chokach and U, and in the north of the main island, where the columnar basalt formation is clearly seen on the face of the precipices. Loosened by the tropical rains, these great natural pillars toppled down into the valleys, where the builders found them lying. No marks of iron tools were found on these mighty masses, which the builders have piled alternately lengthways and crossways one upon another, like the trunks of trees, or like the bits of timber used in building a modern log fence. Masons, I think, call the construction "*headers and stretchers.*" Farmers would call it "*chock and log.*"

A little below Uchentau, our first camping-place, is Nan Tauach, the "*Island of the Lofty Walls,*" the most remarkable of the Metalanim ruins. The great outer walls form a parallelogram measuring 115 feet by 85 feet. Their average thickness is 15 feet, and in height they vary from 20 to 40 feet. Within is a second similar parallelogram of wall, enclosing a couple of ancient vaults roofed in with huge basalt columns. There we made some very successful excavations, bringing to light a number of ancient shell-axes and ornaments and pearl-shell shanks of native fish-hooks. All the time the king of Metalanim fancied we were digging for hoards of buried gold and silver, and kept sending over for his share. The precinct was thickly overgrown with all kinds of tropical shrubs and creepers. In many instances cocoanut-palms, breadfruit-trees, and huge banyans, or Indian fig-trees, had sprung up in the inner court-yard. The walls themselves were covered very thickly with masses of fern and climbing vines, which we had great difficulty in clearing away in order to obtain satisfactory photographs of the stonework. In the middle of the inner courtyard was a fine Ixora-tree, a waterfall of scarlet blossom, with which I would not allow my workmen to interfere.

ILLUSTRATIONS.

No. 1.—Nan-Aua, the nephew of Man-Chila, the Rocha, or Rajah, of the Kiti tribe, SW. coast of Ponape.

No. 2.—Wild bananas and sago palm in the Ronkiti valley, SW. coast of Ponape.

No. 3.—Principal gateway to the walled island of Nan-Tauach in the island city of Nan-Matal, Metalanim district, E. coast of Ponape.

No. 4.—Island of Uchentau-Nan-Matal, showing canal below.

No. 5.—SE. angle of great outer wall of Nan-Tauach, with officers of the Spanish cruiser *Quiros*. In the background an enormous *Aio* or banyan-tree firmly rooted in the stonework.

No. 6.—The haunted island of Pan-Katara to the south of the ruins of Nan-Tauach, partially cleared of jungle.

No. 7.—The brother of Paul, the Ichipan, or king, of Metalanim, holding in his hand a carved dancing-paddle of hibiscus, and wearing a *tur* or belt of banana fibre, on which are strung rows of rectangular shell ornaments, pink and white, with a minute heading made of tiny circles of shell.

No. 8.—Three girls from the Paliker district on the NW. coast.

OLKHON AND THE BURIATS.[1]

THE old Olkhon division, now forming the Kutulika and Elantsa departments of the Verkholensk province of the Irkutsk Government, lies at the foot of the north-eastern prolongation of the Saian range, on the so-called Coast range, and includes the island of Olkhon in Lake Baikal. This island, situated in the north-western part of the lake, lies approximately between 52° 58′ and 53° 55′ N. lat., and covers an area of about 290 square miles. Buriat lands lie also on the mainland, extending to their greatest length along the shore of the lake for a distance of more than 130 miles. The central point of this territory is the Olkhon Gate, between the south-western extremity of the island and the mainland, in long. 124° 24′ E. On the north the Kutulika district borders on the lands of the Tunguz nomads, on the west on the domains of the Manzurskaia commune. On the south the lands of the Elantsa Buriats dovetail into those of the Manzurskaia settlers and border on the domain of the Buriats of the Alaguëf family; on the east they are washed by the waters of Lake Baikal.

The surface is covered with mountains running in all directions, and valleys through which flow small streams and brooks. The inhabitants are settled on the banks of Lake Baikal and the sound called the Maloie More and in the valleys, particularly those watered by brooks or springs. A small rainfall, a comparatively low mean summer temperature, consequent on the cooling effect of a large sheet of water, strong winds raging most fiercely when Baikal is not covered with ice, are the characteristics of the climate.

Of the elevations of the country the most important are the north-western mountains of the Baikal valley—the Baikal range of former geographers—consisting of two ranges, the Coast and the Onotski, and the offshoot of the Coast range forming the Olkhon and other smaller islands. The Coast range is a massive chain of broad flat mountains, rising to a height of more than 4000 feet, and skirting almost the whole length of the shore. It forms the watershed between the Angara and Lena basins on the one side and that of Lake Baikal on the other. On the latter side are the rivers Goloustnaia, Great Buguldeik, Anga, and Sarma, of which the last two traverse the Olkhon district. A small part

[1] Brief notes from *Olkhon*, by P. V. Kulakof. *Zapiski* of the Imp. Russian Geogr. Soc. (Statistical Branch), Tom. viii. No. 1.

of the coast lands lying to the south-east of the line between the mouths of the Buguldeik and Sarma is traversed by much lower mountains of a different character, forming the commencement of the so-called Inner Baikal mountains. These approach the south-eastern flank of the Coast range, being separated from it by a series of long valleys and cut up by valleys into parallel ridges, which here and there assume an Alpine character on a small scale. To the south-east this region abuts on the Baikal lake in steep, craggy slopes, and on the south-east, north-east, and partly on the south-west, is interrupted by the waters of the lake and the Maloie More. By the latter it is divided into two parts, the south-western on the mainland and the Olkhon island. These elevations do not form a complete whole, but are, as it were, the remnant of mountains formerly occupying the site of the present Baikal depression. The other islands in the lake belong to the same system, as well as the Sviatoi Noss, which essentially constitutes a rocky island of great height (4000 feet above the lake) connected with the mainland by a narrow isthmus.

Parallel to the Coast range, but farther from the shore, another much lower range runs along the mainland, the Onotski. It parts the basin of Lake Baikal from that of the Lena, and for a short stretch from the Angara. These mountains have a stony structure, and their valleys are enclosed by rocky slopes. In their lower parts the valleys are clothed with woods of larch, red pine, Scotch fir, cedar, and birch. The crests are quite bare or scantily covered with moss, and are only for a very short time free from snow. The whole country round the lake to the north of the river Buguldeik consists of mountainous forest-clad wilds, sparsely inhabited on the banks of the rivers. Olkhon alone differs in character from the other elevations; the poverty of the forest vegetation, especially in the northern part, at once catches the eye. Three-fifths only of the higher parts of the range are covered with dense forest, while the rest of the island produces poor grass or is stony or sandy, very much like the heights of the mainland close by the shore.

The Great Buguldeik, called by the Buriats Tyia, 38 miles long, has two important tributaries on the left bank watering the Olkhon district. The Khara-zherghi (Black valley) occupies a broad valley almost joining the valley of the Buguldeik with that of the Anga; the other, upper, tributary is called Magaita. The next stream, falling into the lake four miles from the Buguldeik, is the Little Buguldeik (the Khoia of the Buriats), with a valley eight miles long. Much more important is the next river northwards, the Anga (the Akhta of the Buriats), the largest river of the district, attaining 46 miles in length. Its headwaters descend from the highest points of the Coast range, known as the Khargoi barrens (3924 feet above the lake), only 16 to 18 miles from the mouth, so that the river makes a great curve to the west and south-west. The river is formed by the Great Anga and Middle Anga, and receives the Little Anga, Arenga, Bortotala and Asa on the left, and the Khargituï, Buluk, and Kharbagura on the right, and breaks through the Coast range in a narrow ravine. Here it is joined by other tributaries, and, as it passes across the coastal strip, receives the Elantsa on the right and on the left the Ulan-Burgass, the most important on this

bank, with a valley 13 miles long, which is fed by some springs which never freeze.

Another river of some importance is the Sarma, formed by the Tokho and Khandulyn-Garkhon, which enters the Maloie More by a rather broad delta (1⅓ miles). This delta, in some places marshy and meadow land, but for the most part stony and covered with poor grass, adjoins the steep slope of the Coast range, intersected by the deep and picturesque valley of the Sarma. The Kurma and other smaller streams descend to the lake between the Sarma and the farthest outlying village of the Buriats near Cape Pokoiniki. Beyond this the shore is uninhabited up to Cape Muzhinai, where a few Tunguz camps begin to appear.

The island Olkhon is very deficient in water; few of its numerous valleys contain springs, and those are insignificant, usually dry in summer. The north-western flank has the best supply of water.

Lake Baikal, the Dalai-nor of the Buriats, exceeding 400 miles in length, with a maximum breadth of 53, occupies an area of 13,500 square miles, and in extent ranks among the largest fresh-water lakes of the world, while its unusual depth (maximum sounding, 803 fathoms) raises it to a still higher place in respect of volume. Its surface lies 1561 feet above sea-level. The difference between the height of the water in summer, when it is raised by the melting of the snow, and in winter, when the streams are frozen up, amounts to three feet, though in some years it attains to as much as seven. The water is very transparent, the bottom being clearly visible at a depth of thirty feet. It freezes over late in the year, about December 22nd, the ice forming first on the shore and gradually extending into the middle. The mean thickness of the ice is four to five feet. At the end of April or the beginning of May the ice disappears. The Maloie More freezes over a few days earlier and keeps its ice covering a few days longer. The prevailing winds are the north-east and south-west, that is, in the direction of the longer axis of the lake. The north and north-west are dangerous, raising a heavy swell and driving boats on to the rocky southern shore. In spring the winds are particularly violent and dangerous.

The lake is of great economical value to the Buriats on account of its fish and seals. The market fish are *Coregonus omul*, Pall., grayling (*Thymallus Grubii*, var. *baicalensis*, Dyb.), salmon, turbot, sturgeon, perch, pike, etc. Twenty-one kinds are known to live in the lake. The seal, similar to that of the northern seas, is most frequently met with at the Ushkani islands to the north of the Sviatoi Noss.

Of other lakes may be mentioned those of the Tarzhiran valley (basin of the Anga). According to Cherski there are eleven of them, not exceeding one-third of a mile in diameter. They lie 218-332 feet above the surface of the lake, and have no outlet. At one time Glauber's salts used to be obtained from the last of them, but Russian salt has now taken its place. Several other small lakes are scattered along the coast and on Olkhon, all originally small bays formed by sandbanks, which eventually separated them entirely from the larger lake.

In the Olkhon district, as in all the country round the Baikal lake,

archæan rocks of the Laurentian system are widely distributed. On the north-western shore of Lake Baikal they extend over a zone varying from $1\frac{1}{4}$ to 26 miles, and form the whole of Olkhon island. In several places useful minerals have been found. On the river Anga iron-ore occurs, and was at one time worked to a small extent; it also exists in the rocks round Khardo bay, to the east of the mouth of the river Onguron, to the east of the mouth of the Sarma, and near the salt lakes of Tarzhiran. Quartz and felspar are abundant in various places, and are extracted for glass-making near Kuntinski on the river Elantsa, on the upper waters of the Little Buguldeik, and near Cape Ulan-Nurski. Fireclay is plentiful, and is used for making stoves and in the houses of the Elantsa Buriats. Copper-ore exists somewhere in the island of Olkhon, but it has not been mined for more than a hundred years, and the present inhabitants do not know where the mine is. Alluvial gold is not uncommon, but being of low grade does not in general repay the miner, and is only worked on the upper Zama. Grindstones, graphite, and fine-grained marble complete the list.

The fauna and flora of the district are much the same as those of other parts of the Irkutsk Government. The Olkhon island is somewhat different from the mainland in that it is very poor in animal and vegetable life. Its forests consist chiefly of red and white pine, Scotch fir, larch, poplar, aspen, and birch. On the eastern side they form only small thickets. On the slopes of the hills the flora resembles that of the steppes of Mongolia and Transbaikalia, while again it has some affinity with the vegetation of the tundras of the extreme north. Many forms occur on Olkhon which are found in Transbaikalia, but not on the western side of the lake. The fauna, like the flora, is poor in the number of individuals. The forests of Olkhon, like other forests in the Irkutsk Government, harbour roe-deer, foxes, wolves, polecats, ermine, hares, etc.

The name Olkhon means in the Buriat language "dry," and fitly describes the island, where rain or snow seldom fall, and the water-supply is consequently small. Hence existence is precarious, agriculture being almost impossible, and cattle-grazing only to a small extent, so that, were it not for fishing and sealing, even the scanty population now living on the island and the shores of the Maloie More would vanish. The number of inhabitants is gradually diminishing, and is much less than that of the Mongolians, who formerly dwelt in the country, as the numerous stone walls, tombs, and other remains abundantly testify. Investigations have shown that these Mongols, as they in all probability were, had reached the iron age, possessed cattle and pottery, held communication with the Chinese, and sometimes burned their dead, sometimes buried them.

The first acquaintance of the Russians with Olkhon dates from the year 1643, when the Cossack leader, Ivanof, left Irkutsk with seventy-five men and came to Baikal, and crossed over to the island. Georgi was the first to examine it scientifically, and since then several travellers have visited it, the best known in this country being Radde and Obruchef.

The population of the district consists of nomad Buriats, with the

exception of the inhabitants of three villages, who have been converted to Christianity and married Russian women, and even many of these change their dwellings at some time of the year. The true nomads dwell in camps, having summer and winter resorts, and some of them moving in autumn also. They move to their summer dwelling towards the end of May, and return to their winter abodes early in October. This migration has for its object to reach the best pastures, and to allow the grass at the winter settlements to grow for hay. Where the summer pastures are not far distant, the Buriats do not migrate, or at most move a few hundred yards from their huts to an encampment.

The prevailing religion is Shamanism. The settled Buriats all belong to the Orthodox Greek Church, but there are few Christians among the nomads, especially in the Kutulika district—only 37 out of a total population of 2578, or 1·4 per cent. The shamans, whose office is in most cases hereditary, conduct public prayers and undertake to cure all diseases except leprosy, but among the Buriats only; they are present at the erection of poles on which are hung skins, and at the purificatory aspersions, to conduct prayers for rain and for success in fishing. They receive payment for their prayers and other functions in money and in kind.

The food of the Buriats consists of corn, dairy produce, meat, and fish. Corn they buy, or obtain it in exchange for fish, chiefly from the colonists of the Verkholensk district; it is mostly rye, only the more prosperous buying wheat, and then in very limited quantities. In winter the Buriats bake bread like the Russians, but in summer they cook dampers on hot stones, as there are no stoves in the summer camps. Meat constitutes a large proportion of their food, both that of domestic animals and of wild animals, seals, etc., killed in the chase; even that of domestic animals that have died is not despised, even by the well-to-do. Their milk diet is very varied. Though the cattle do not give much milk, their number is so large that dairy produce is abundant. In summer a light alcoholic drink is prepared from it in very large quantities, and preparations are made of coagulated milk. Fish is eaten by most Buriats only during the season, and dried fish is a luxury confined to the rich. Tea is a very favourite drink, boiled with milk or butter, or seasoned with salt; sometimes it is mixed with fat and meal.

In dress the Olkhon Buriats are behind the others. Their clothing is more simple and primitive. Sheepskins, home-dressed, are the usual material. Russian goods are, however, making their way into Olkhon households.

As in dress and religion, so in many of their customs, the Buriats in Olkhon have retained the manners of their forefathers to a greater extent than other branches of the race, having singular modes of addressing one another, and of doing honour to guests. Their cordiality and hospitality are very striking.

More also than among other Buriats, the women hold an inferior position. Polygamy is common, and women are not allowed to approach certain holy places, and in other ways do not enjoy the same privileges as the men. Wives are bought, and the price is exorbitant considering

the condition of the people, £15 to £20 being the average. The wedding is celebrated at a great feast, with much noise and merriment. Every tent contributes its share of the *tarasun* (drink made from fermented milk) or its equivalent in money—a custom no doubt dating from the time when weddings were celebrated by the community. Men marry at a very early age, either that they may obtain the services of a wife, or that their children may be able to work before the parents are far advanced in life. The Buriats are exceedingly fond of public amusements and festivities in general. In Olkhon, owing to the poverty of the people, they are less frequent than among other sections of the race. Great drinking-bouts take place in summer, when the cows yield most milk, but the majority of the Olkhon men are then off to the fishing.

The population of the Olkhon district in 1895 numbered 5313, of whom 2658 were males and 2655 females. On the whole, then, the sexes are nearly equal, but there is great difference in numbers in the individual clans.

The profitable lands in the district occupied by the Buriats cover an area of 14,270 acres; all the rest of the country is waste Crown lands, of which the natives make use of only insignificant patches as meadows. Out of every hundred acres, 61·6 are afforested, 31·1 mountain pasture and steppe, 6 meadow, and 1·3 arable land or fit for cultivation. Hence, according to these figures, which are official, the acreage for each family is very small. M. Kulakof, however, from his own observations calculates the area, excluding upland pastures and forests, actually occupied by fields as 8100 acres, which gives about 6·9 acres to each household. Even this proportion is very small compared to the land held by each head of a family in other departments of the Verkholensk province.

Each hamlet or group of hamlets has in its occupation an allotment or several allotments, but legally the whole of the lands are the common property of the nine clans of Buriats in the Olkhon district, and may at the desire of the majority be redistributed among the clans and encampments. The upland pastures and woods are free to all. Thus, on Olkhon island, for instance, the Buriats of the south-eastern part drive their cattle, when the crop of grass is scanty there, to the north-western end. The woods are equally common property, and quarrels never arise about their utilisation, though in some places wood is so scarce that the Buriats are obliged to burn dried dung for fuel. Only a few sacred groves are exempt. In the above circumstances a final alienation of property is impossible, but meadow-lands and clearings are to a small extent leased, for a term of two or three years only, in view of the possibility of a new distribution being made, and old men sometimes hand over their property to others on the condition that they are to be supported during their lifetime.

Since the beginning of this century, efforts have been constantly made by the Government to extend farming and gardening among the native tribes, and in many parts of the country these efforts have been crowned with success. In the Olkhon district, however, in consequence of the dryness of the climate and the violent winds, the results have been comparatively insignificant, the land under cultivation among the

nomad tribes being only ten acres to every hundred persons in the Elantsa district, and one acre in the Kutul district. Cultivation succeeds best among woods and in deep hollows, whereas near the lake it is in general impossible. The clearing of the soil demands a vast amount of labour, and considerable expense is incurred in the purchase of ploughs, harrows, and other implements, and all this trouble and expense is often useless, so that a large quantity of arable land is abandoned, and the administration, however zealous, cannot, in such circumstances, bring pressure to bear on the Buriats. Indeed, they are not listless and idle, but are quite ready to cultivate the land wherever they can do it profitably. One year the land is left fallow; the next year corn is sown on it. When the land is exhausted it is allowed to lie fallow for a long time. In 1895 the cultivated land in the Olkhon district was 293 acres, and 333 acres were fallow. Many farmers who have very little arable land sow it all one year and let it all rest the next.

The principal occupation is cattle-grazing, and on that depends the material well-being of the population. But the pastures are so poor, and the meadow-lands are so deficient in quantity, that the Buriats are obliged to buy large quantities of hay and straw, or send their cattle in the winter months to be fed in other districts, and pay for their keep. Clearing the land and artificial irrigation are the special work of the farmers in this country, and did not the Buriats expend a large amount of energy in thus increasing the produce of their land to the uttermost, their most reliable means of subsistence would be cut off.

Patches of ground cleared from trees or stones, manured, and sometimes artificially irrigated, are called *utughi*. The work of clearing stony ground is exceedingly heavy, and the return for the time expended is very small. The stones must be torn out of the ground and carried to one side and the holes filled up; where it is possible to procure water, even if it be the temporary supply from the melting of the snow, trenches are digged to distribute it over the clearing and embankments made to keep in the water. It is only the extreme poverty of the people and the absence of any sure means of earning money that induces them to spend their spare time in such laborious and badly-paying work. Irrigation is practised to a large extent, 446 acres or 65·5 per cent. of the *utughi* being artificially supplied with water. Yet the yield of hay is below the average of the adjoining districts, for the precipitation is small, and most of the meadows are situated in stony places, and a considerable part is often covered with heaps of stones. A more thorough clearing of the ground and better manuring would much improve these lands. As for irrigation, antiquated methods are retained, and an exact topographical and geological survey would find out how far irrigation could be extended, where wells could be digged and water stored in basins.

The settled and nomad Buriats keep horses, cattle, sheep, and goats. The cattle much resemble those that are brought to the shambles of Irkutsk from Mongolia, but are smaller. The most common sheep have white fleeces of little value. The horses and cattle number 7526, and the sheep and goats 33,404. The cattle are sold in autumn to dealers

from Transbaikalia and the Irkutsk district, and the fleeces and hides are also sold, but no money is earned by the sale of butter or milk.

Fishing is of much more importance in the Olkhon district than in any other part of the Irkutsk Government, for elsewhere the produce is consumed locally, whereas the fish caught by the Olkhon Buriats are carried all over the Government and even beyond its limits, and the money earned in this occupation forms a considerable part of the income of these Buriats. For this work the men form associations consisting each of fifteen men in the Maloie, but fewer in number for the fisheries in more distant parts of the lake. Each association is provided with a large and a small boat, with anchors, sails, net, and winches to pull in the net, which are usually the property of one of the partners. Part of the catch is consumed by the crew, and some small part is disposed of to Buriats and Tunguzes on the shore, but by far the largest proportion comes into the open market. While the Olkhon fair is being held, from June 27th to July 27th, the fish is there sold fresh. Later in the year it is salted and sold to dealers. The industry is not apparently increasing or declining, the same number of Buriats going to the fishing every year.

The seal fishery has been prosecuted from old times. The number of seals diminishes according to the Buriats, while the fishermen are more numerous. The fishery is very uncertain; in 1891 seals were not seen, while in 1894 they were very plentiful. The season commences within ten days after Lady Day, and lasts about a month. The hunter, in white shirt and hat, with gun and sledge, goes on to the ice and looks about for seals which come out of the holes they make in the ice to sun themselves. When he catches sight of a school he sets up a calico screen on his sledge, and pushing the sledge before him creeps towards the seals until he gets within shot. Nets of horse-hair also are set at night at the breathing-holes. In the villages on the shore of Lake Baikal and on Olkhon island, the Buriats often hunt seals for a few days at a time for their own consumption. Dogs are used to find the breathing-holes, and the seals are shot or caught with a net let down under the ice. In 1895, an average year, the 326 Buriats engaged in the chase shot 2437 seals, which yielded fat, meat, and skins to the value of some £678, or about £2, 1s. 7d. per man.

On land the Buriat hunter shoots squirrels with a flint-lock gun; not only in the woods of his own district but also on the north-eastern shore of the lake near the places where the autumn fishing is carried on. In 1895, 16,000 squirrels valued at £200 were shot. Woodcock, polecats, bears, wolves, and roe-deer also fall to the sportsman's gun.

There are also among the Buriats some coopers and carpenters, and a few workers in iron, copper, and silver.

The Buriats often take their fish into the corn-growing districts and barter it for corn, or sell it, and buy corn with the money. But the fish is more frequently sold to dealers on the shore of the lake or at the Olkhon annual fair, which is held in the bay of the Olkhon sound. There the Buriats buy manufactured goods, salt, casks, household utensils, agricultural implements, etc. The turn-over at the fair in the year 1895 amounted to nearly £170.

THE FRENCH NIGER TERRITORY.

DURING the past twelve years a succession of French explorers have traversed the country between the Niger and the Gulf of Guinea in all directions, M. Binger having made his famous journey in 1887, and the expeditions of Blondiaux and Pobéguin having been accomplished in 1898. There remain, no doubt, certain problems to be solved, and the western parts of Gourounsi and Mossi contain many blanks; but when MM. Hostains and d'Ollone return from their journey, and when Commandant Destenave has published the results of his last expedition, all the region comprised between the Niger and the Gulf of Guinea, nearly 400,000 square miles in area, will be in general well known in Europe. M. Camille Guy has therefore chosen this time to compile a sketch of the geography of the country, its natural resources, people, etc.[1]

GEOLOGY.

Commencing with the geology, M. Guy states that the country emerged in Archæan times above the ocean. In the north, east, and centre of French Guinea lies a zone of granitic rocks with an altitude of 2300 to 2600 feet. Towards the west this region is bordered by a narrow band of dark or bright schists, succeeded on the coast by plateaus of sandstone almost horizontal. Sandstone has been observed in the region of the Bandama, where also crystalline rocks were observed in the bed of the river by M. Eysseric, but from Fresco westwards M. Pobéguin noticed on the coast only granites and hard schists, and no trace of sandstone or limestone,[2] and above these reddish friable rocks of metallic appearance, such as frequently occur in Africa. Inland as far as the banks of the Niger lies granite mixed with ferruginous quartz and not infrequently auriferous quartz. All the terraces which dominate Dahomey are composed of quartz and ferruginous conglomerates, and the granite crops out everywhere, and from Carnotville to the Niger the character of the country is the same.

But farther north sedimentary rocks occur more frequently in the deep valleys hollowed out of the elevated mass of French Guinea, none of which contains fossils. (The only place where they have been found is on the coast just beyond Fresco, where M. Pobéguin noticed agglomerations of large madrepores and ammonites, and two banks of different fossil shells rising above them to a height of 50 to 60 feet above the sea.) Dolomite and ferruginous clay or laterite cover large areas. On the upper Bandama red clays and limestones are also present, and according to M. Ballot, the Delcassé mountains consist of a granitic core enveloped in sedimentary strata. M. Alby states that the Borgu country is composed of granitic hillocks, but if this be the case, the nature of the land must change again, for the route to Gourma lies over dry mud and limestone. It is therefore evident that the two zones are not

[1] *Renseignments Coloniaux*, Nos. 1-3. Published by the Comité de l'Afrique Française.
[2] *Bull. de la Société de Géographie*. 3e Trim. 1898.

distinctly separated; the sedimentary rocks stretch southwards between the Bandama and the Volta, while the granite encroaches on the sedimentary region near the Niger.

Beyond this zone comes the sand, which appears in places as far south as Sansanné-Mango. In Mossi and Gourounsi there are extensive sandy tracts, and Liptako is a sandy plain. Macina is likewise traversed by groups of sandhills up to the banks of the great river, and forms the threshold of the Sahara.

From these and other somewhat vague notices, it may be concluded that four distinct zones may be distinguished between the Gulf of Guinea and the Niger: on the coast a zone of alluvium and sand extending a few miles to the foot of the first rocky terraces; a granitic region of which the irregular northern limit lies on an average nearly on the 10th parallel; a more uniform region, where limestones occur fairly frequently, stretching from the 10th to the 14th parallel; and, lastly, a sandy belt extending to the banks of the Niger.

The whole country has been profoundly modified by the action of glaciers and volcanic eruptions. The deep hollow that penetrates far into the heart of Fouta Djallon (the valleys of the two Skarcies) was the bed of an ancient glacier which descended from the highlands, pushing before it its terminal moraine to the neighbourhood of Freetown. The lateral moraines may be perceived near Kaba and Koniakou. Commandant Toutée and M. Ballot have several times noted the presence of igneous rocks in the heights in the north and west of Dahomey, and the abundance of gold in the more western regions, and of iron in the whole country embraced by the bend of the Niger, shows that the whole surface has been convulsed by numerous volcanic eruptions.

Orography.

The orography of the Western Sudan has been planned out by geographers according to a harmonious system. Since the Atlas in North Africa corresponded to the plateaus of South Africa, it was supposed that the giants Kilimanjaro and Kenia must be counterbalanced on the west by elevations not much inferior, and therefore the mountains of Kong were invented, a formidable barrier 13,000 high, and even names were given to some of their mythical summits. Another supposition was that this chain of mountains stretching from Fouta Djallon across the Niger had an east and west direction. M. Binger, however, on his second journey disposed of the former error; instead of majestic peaks, he found nothing but plateaus or hills not exceeeding 2600 feet in height. He also suspected the correctness of the east and west orientation, and the explorations of the past five years point to a different conclusion. The elevations lying between Fouta Djallon and the Lower Niger appear to be arranged in parallel ranges running, with a few exceptions, approximately from south-west to north-east.

In Fouta Djallon the surveys of Captain Salesses have shown that the country is traversed by ranges running from south to north, and extending as far as the Senegal. They rise from a plateau which is

more elevated in the north than in the south, a phenomenon that occurs throughout the Niger region. Hence Guinea may be represented as a series of terraces, the outermost being that of Fouta Djallon, which varies in altitude from 300 to 3900, owing to the general slope of the country from south to north. From this run out southwards the sandstone plateau of Kanéah, between the valleys of the Samou or Badi and the Great Skarcies; the ridge of Tamisso separating the Great and Little Skarcies; and the ridge of Kolossaghea, between the Penséli and Mongo, affluents of the Little Skarcies. Similarly on the north series of hills branch off, as those of Letansan, which attain an absolute elevation of 3700 feet, and those of Bafoulabé.

The second line of elevation has been recently described by M. Blondiaux. Starting probably in Liberia, it terminates towards the east at Tiola, parallel to the highlands of Sikasso. At first comparatively low (1600 feet at Koro), it rises to 2600 feet between the Sien-ba and Tien-ba rivers, culminates at 3300 feet in the vicinity of Lalasso, and then gradually declines to 1300 feet near Tiola. In some places there is a double range and even triple.

A third series, invariably directed from south-west to north-east, runs for a considerable distance inland from Tiassalé, turning at its extremity towards the east. M. Eysseric states that a mountainous chain exists between Tiassalé and Kong, or rather two, for the Bandama flows in a valley enclosed by two walls of considerable elevation. This range increases in height towards the north till it coalesces with the extremity of the second line of elevations near Sinkasso in Mt. Mina. The greatest altitudes are found in the Fouta Djallon mountains, near the sources of the Niger; but the orographic nucleus of the whole country is, both from its central position and the importance of its streams, Mt. Mina, which covers an area of 7700 square miles, and contains the sources of the Volta, Banifing, Comoë, and Bandama. Probably it is continuous with the highlands of Hombori, which rise in abrupt cliffs to a height of 2600 to 3300 feet above sea-level. These highlands do not form a compact chain, but expand here and there into plateaus, whence short spurs radiate in all directions.

Though their orientation is unmistakable, these elevations have not the clearly marked direction presented by the chain which, starting from Akra, skirts the right bank of the Volta under the name of Akumu, and then, crossing to the left bank, runs north-eastwards with a height of 1600 to 2000 feet. From Bismarckburg these hills continue in a single chain in the direction of Kouandé, expand into the Atakora group, and die away in mere undulations at Botou in Gourma, or perhaps in the neighbourhood of Say. The most important part of the system is the mountains of Atakora, which, not exceeding 1600 to 2000 feet in altitude, extend north-eastwards into Gourma, and south-westwards to Yendi and Salaga, and separate the affluents of the Volta from those of the Niger and Ouémé.

Far more complex from every point of view is the Dahomey system. It contains few heights of importance except the group at the centre of which Carnotville has been built, named by M. Ballot the Delcassé

mountains. In the southern part, between the coast and lat. 7° 5′ the elevation is small; from lat. 7° 5′ to 7° 35′ the country is more hilly but never rises above 650 feet; between 7° 35′ and the Delcassé mountains the country is more decidedly hilly, and is cut up into a series of ridges diverging somewhat southwards. Nowhere but in the Delcassé mountains are there summits rising above 2000 feet, while this great mass rises to 3900, and is the centre from which spring the chains that traverse Dahomey.

Naturally the orography of the bend of the Niger is not as simple as the scheme just described would seem to show. Besides an upheaval from south-west to north-east there has been another at right angles from south-east to north-west, but the elevations it has produced are in general of lower altitude and of much less frequent occurrence. On the parallel heights of Fouta Djallon, running north and south, abut lines of heights running south-east and north-west, and the chains explored by Blondiaux are connected with Fouta Djallon by transverse chains of hills. The plateaus of Kong send out north-westwards ranges which converge with the western ramifications of the mountains of Lalasso and Tiola. So too an important offshoot from the Atakora group culminates at Pama and passes between Mossi and Gourounsi. These twin lines of upheaval are still more apparent in the complex system of Dahomey. The older direction, from south-south-east to north-north-west, is marked by chains of no great height, presenting neither scarped summits nor deep valleys. Toutée has noted a series of hills running from Lokoja, on the Niger, to Chaki, where they collect into a kind of plateau.

In consequence of the south-west and north-easterly direction of the mountain ranges, the rivers, running from north-west to south-east, parallel to the older lower line of upheaval, break through one or two parallel chains before they reach the coast, and therefore form groups of rapids.

Hydrography.

The rivers of Fouta Djallon, with the exception of the Niger, are narrow and shallow, and crossed by rocky sills which are uncovered in the dry season. They may be easily spanned, says Captain Salesses, who surveyed the route for the railway, by bridges 30 to 40 yards long. The broadest is the Kolenté (Great Skarcies), which measures 65 yards at the crossing place. Besides the depressions containing the two Skarcies there are two others to be crossed, the one occupied by the Mongo, the other by the basins of the Tahili and its affluents, the Ouankou and the Benty; but they are of small dimensions.

The network of rivers which flow between the Niger and the Bandama is far less known, and for a long time there was much confusion between the courses of the Bandama, Sassandra, Cavally, and Férédougouba, and it has been reserved for Blondiaux to finally clear up the hydrography of the country. He has shown that the Férédougouba and the Sassandra or Saint André are one and the same. It is formed by the Boo and the two Goueïas, which meet not far from Gouanandogou. At its junction with the Bafing, long considered an affluent of the Bandama, it is 270

yards broad, but farther south it is divided by islets and rocks, which, however, do not impede navigation in canoes even when the water is very low. For more than 60 miles from the coast the Sassandra is a regular staircase. M. Pobéguin states that there are not fewer than twenty-five rapids in this interval, and that the change of level from Kouati to the mouth is 260 feet. From Dabalas to Ténindiéri the valley of the Sassandra approaches so closely to that of the Bandama rouge that certain affluents of the latter have been attributed to the Sassandra. The most important of the lower affluents is the Zo on the right bank, which enters the main stream 125 miles from the coast, and is said to be navigable. The Cavally, which forms the boundary of Liberia, is navigable at high water even by small steamboats for 50 miles, as far as the great rapids of Gré. About five miles from its mouth it expands rapidly to a breadth of 1600 to 2100 yards.

The Bandama is formed by the Bandama rouge and the Bandama blanc, the former inclining somewhat to the west. The latter is the main stream and must have its sources near to Fanaloko, for there it is only a large brook, but it is soon swelled by the tribute of its affluents, and in the rainy season becomes a furious torrent. A little south of the seventh parallel, at Tombo, it is joined by the Bandama rouge, formed by the union of the Banoroni and Marahoué about 9 miles from Koyradougou, and known there by the name of Diou. Lower down the bed of the stream is encumbered by gigantic blocks, and its tributary the Zini, which joins it a few hours' journey above Tiassalé, is navigable for only a short distance. A few hundred yards above this town the Bandama precipitates itself over a step of rock 16 feet high, and below, as far as Toumoumou, islets and rocks divide the stream, and produce numerous rapids. Steamers can ply from Grand Lahou to Bouroubourou, 50 miles up, and canoes find their way from the middle of June to the middle of October up to Tiassalé.

While the Comoë had been explored by Binger[1] throughout nearly its whole length, and the lower course of the Volta was sufficiently known, this was not the case with the headwaters of this river before the patient researches of MM. Baud and Alby. Baud first distinguished the White Volta, the Black Volta, and the Dako, and showed that the Poplogon and the Black Volta were quite distinct. Between Koutoum and Sansanné-Mango he struck the Kara, 100 to 120 yards wide, which runs north-westwards to join the Dako or Kouma, an affluent of the White Volta. This stream rises between two and three miles from Ouaghadougou (Wagadugu), and on the Anglo-German boundary, near Wale-Wale, has become a river more than 300 yards broad, running between banks 25 to 30 feet high. A little above Wale-Wale, the Poplogon, four or five hundred yards broad, enters the White Volta. On the left bank the affluents form a yet more complicated system. The Goulbi Nandzé, once believed to be an independent river, is an affluent of another Goulbi or Pindjéri which joins the Dako near Sansanné-Mango. The natives of Tingourkou affirm that it comes down from a

[1] *S.G.M.*, vol. vi. p. 206, and vol. ix. p. 203.

mountain in the north of Mossi. It contains no water in the dry season, whereas the Pindjéri is a fine river fully 10 yards broad in the dry season, with a rapid current, and extending to a width of several miles during the rains. Another stream joins the Goulbi-Kouma (Dako), the Ouarangou, flowing from Ouabou in one of the parallel valleys of the Atakora.

All the streams of Dahomey running between the different chains with a direction on the whole from south to north finally collect into three rivers—the Ouémé on the east, the Kouffo in the middle, and the Mono in the west. They are all more or less torrential, with beds encumbered, especially in their upper courses, by enormous rocks, but they contain water throughout the year. Certain natives affirm that the Ouémé is an offshoot of the Niger, while others assert that it issues from a large lake at lat. 13° N. between Mossi and Gourma, and which is fed by the floods of the Niger. On the left bank it receives the Beffa, 50 yards broad, and the still more important Ocpara, while several smaller tributaries flow in on the right. Below Dadjo the Ouémé is 220 yards broad, and 26 to 33 feet deep, but below its confluence with the Zou it divides into two arms, of which the largest on the west is called the Zoumi or river of So. The Ouémé is navigable as far as Samio, in lat. 7° 28′ about.

The Kouffo is formed by two branches separated by a chain of hills. At 6° 31′ N. lat. it expands from a breadth of only 30 yards into a long lake nearly a mile across, contracting again about 7 miles from its mouth.

The Mono, now a German river, has abundance of water at all seasons, and is navigable up to Athiémé, and at high water to Togodo.

The above are the principal rivers that flow into the Gulf of Guinea partly or wholly through French territory. There remains only the Niger to be described.

The Niger has only recently been explored throughout its length. Until the first expedition of Mungo Park, in 1795, geographers were ignorant even of the direction of its course, and Buffon made it run from east to west, placing its mouth near where its sources actually lie. The emotion of Park when he came in sight of this mysterious river is therefore quite comprehensible. On his third journey Mungo Park perished in the rapids of Bussa, and many years were to elapse before a thorough knowledge of the river was to be obtained. René Caillié crossed the Niger in 1827 at the altitude of Bammako, and Barth superficially surveyed its course from Say to Kabara.

It was not till about 1860 that the exploration of the Niger as a navigable artery was commenced, and then only in the upper course, from Bammako to Kourioumé. Neither Mage in 1867, nor Caron in 1887, imagined that one day a boat flying the French flag would descend the Niger to its mouth. Their object was simply to connect the Senegal with the Niger, and thus gain Timbuktu, the great commercial metropolis, as was supposed, of West Africa; and when in 1883 General Borgnis-Desbordes ordered Gallieni to make for the Niger, it was because he regarded it as the only possible route to the north. A start was thus made, and the splendid journey of Binger in 1889, the exploration of

Jaime at about the same date, and the journey of Monteil across the bend of the Niger in 1891, extended French influence into the interior of the country. It became evident that France would acquire an immense domain in this region, and it was not less evident that the Niger alone could give it unity and life. Still, when Lieut. Jules Davoust conceived the project of descending the river in a gunboat to its mouth, the idea seemed too hardy. But a few years later Toutée ascended it from Bajibo to Zinder, and Hourst descended from Kabara to the Forcados river.

The Niger, or Joliba, is formed, near the village of Laya-santo, by the union of the Tembi and Faliko. The Tembi, which is considered the principal branch, rises at the foot of the mountain Konkonante at a height of 2800 feet, in a small, thickly wooded saddle situated 500 yards to south of the ruins of the village of Tembikounda (head of Tembi). It issues from a small basin a little more than a yard in diameter, into which the water filtrates through the soil. This basin is buried in a tangled thicket of reeds, canes, and climbing plants, surrounded by trees of gigantic dimensions. The source was visited by Captain Briquelot on March 1st, 1893, and subsequently by Captain Drouet. Its position was fixed by the Anglo-French Commission, and the co-ordinates given are lat. 9° 4′ 55″ N., long. 10° 46′ 31″ W. The Faliko rises near the ruined village of Dembasoua, three miles east of Boria. The source of the Niger is fetich to the natives, and any one who sets eyes on it is said to die within a year. Numerous legends were attached to it, as that of the marvellous lake in which the high-priest Tembi Seli disappeared for several days; but all these have now been discredited.

On leaving the basin the river is only a tiny thread of water, and near Tembikounda its breadth is only about a yard. It directs its course at first northwards to the twin domes of the Soullou, which make it diverge a little towards the east; it then resumes its northerly direction as far as Nalia (being here 28 yards broad), where it is diverted to the south-east by the Fiba mountain. About five furlongs farther is the famous disappearance of the Tembi noticed by Zweifel. The river is buried for a time under a heap of ferruginous rocks. Beyond Secourala it regains its original direction, which it retains to its confluence with the Faliko. At Soia-Moreia the topographic party under Captain Salesses struck the Niger. He reported that at this place the river is so obstructed with granite rocks and bars that navigation is impossible from Farana to Soïa-Moreïa, and only possible at high water and down stream between Soïa-Moreïa and Bafara, at the confluence of the Mafou. Even at Bammako it is only practicable at certain seasons. It is more to the north, that is, at Toulimandio, that navigation becomes possible at all times of the year, and then only in small boats. This point will doubtless be the terminus of the railway from Kayes to the Niger, as Kouroussa will be that of the Konakry line. From Toulimandio the channel is known; the maps of Caron are as complete as possible, and exhibit all the outlines of the bed with a scrupulous attention to detail and accuracy. Barges and gunboats navigate the river north-eastwards from Koulikoro to Segou-Sikoro, and thence to Sansanding, while the valley inclines eastwards as far as Diafarabe, here turning once more northwards as far as Gurao and even Timbuktu.

It is hardly necessary to mention that within late years French officers have discovered to the west of Timbuktu a whole lacustrine region, the existence of which had not even been suspected. Though the lake Faguibine was marked on maps, such was not the case with the lake Daouna, 10 miles to the south, which at low water extends to a width of 12 miles, while a little more than a mile to the north-east lies another much smaller mere. To the south of Daouna is the mere of Bankore, with a length of $5\frac{1}{2}$ miles and a breadth of 1. Again to the north of Faguibine is the permanent lake of Bonkoro, distant $4\frac{1}{2}$ miles from the former, and connected with it by a creek 7 miles long. Other lakes no doubt exist, for the natives speak of them as extending northwards. Lieut. Bluzet remarks on the importance of such a lake as Faguibine to the natives, as shown by their reluctance to show it to strangers, so that Lenz and Barth heard nothing of it. It is a second lake Chad, the length of the latter being scarcely greater than that of Faguibine, 90 miles.

Timbuktu has three ports; Korieta and Kourioume on the Niger, and Kabara, 3 miles from the river and $4\frac{1}{2}$ from the town. Kabara is separated from the river by a large grass-covered plain, which at high water is flooded as far as Timbuktu, so that the boats of Djenné, carrying about 100 tons each, can reach the town during two months in the year.

Of the right bank of the river in this country little is known; in the Haïbongo region there is a large depression similar to that of Faguibine.

From Kabara the Niger describes a fairly clearly defined curve westwards, being forced northwards by the outer terraces of the highlands within the bend, and at Rhergo inclines to the south-east, and afterwards to the south. In this section it skirts and erodes the dunes of the Sahara, while the right bank is higher and steep. At Tinalchiden are the first rapids, which, however, present no obstacles to navigation. Even here the Niger contains numerous islands, almost hidden at flood time, but exposed to a considerable height at low water. At one time the Niger must have flowed eastwards before it opened for itself a passage through the granite masses which have so long proved impassable to boats. It flows through a narrow defile at Tosaye, though the water even within the gorge is more than 100 yards across, and on issuing it spreads out to double this breadth. As far as Bia it meets with no obstacle, but immediately below Ansongo the bed becomes rocky, and reefs appear, islands are numerous, the most important being the isle of Bouré, and enormous blocks and the violence of the current add to the difficulties of navigation. Rapids succeed one another from Fafa to Karou also, but they are not formidable. Below Karou the river enters the most dangerous part of its course, through the mountains of Labeganga. Sharp turns, rapids, some of them almost cataracts, and thousands of islets among which the water rushes violently, are met with all the way to Tibi-Farca. Between Zinder and Say navigation is fairly easy for small boats, but numerous rocks rising above the water or coming just to the surface would be dangerous to larger vessels.

The section of the Niger from Koulikoro to Ansongo, 1000 to 1050

miles in length, may be easily navigated, and will be of great commercial importance when the railways from the west reach the river. Below Ansongo steam vessels will probably never be able to ply; small lighters only, carrying about a ton, may make the journey till the water has risen to its mean height.

Below Say the character of the river changes; it has emerged from the desert, and its discharge, its floods, and the aspect of the country through which it passes are different. There are more rapids, islets, and narrow passes, for the bed is only 150 to 200 yards broad, but the only serious impediment is the rapids of Bussa, where the stream flows at the rate of 12 to 14 knots, forming billows three feet in height: "These are the consequence," the late Mr. Joseph Thomson remarked, "of the river passing from the easily eroded sandstone to the more durable gneissose rocks of the Metamorphic area."[1]

The description of the Lower Niger need not be carried further, as the officials of the Royal Niger Company extended its influence up to the rapids below Say many years ago, and many British travellers have visited this region. Also a general sketch of its hydrography was given in vol. xi. p. 195.

During its long course the Niger is fed only by rains that fall at fixed seasons, and therefore, except in its upper and lower courses, it receives few affluents. In its middle course it traverses a sandy region, where only tiny threads of water add to the volume of the stream, if they are not lost on the way to it. Its upper basin, on the contrary, is intersected by a multitude of rivers, of which the chief are the Mafou, the Koba, and the Mandan or Balé, which, enlarged by the Konïa, carries to the Niger as much water as the latter contains itself. The beds of these streams are impassable even in canoes, and equally useless for communication are the Fié, the Ouassoulou Balé, and its tributary, the Sankanari. Below Bammako there are hardly any affluents, but at Mopti the Bagoë or Bani almost doubles the volume of the Niger. Farther east again the tributaries become rare, and at length disappear altogether, for the country on the left bank is drained to the Senegal, where it is not a desert. On the other hand the Niger parts with some of its water to fill the creeks which intersect the country in a network, and prevent the adjoining lands from becoming perfectly sterile. The few water channels that cross the country are dried up six months in the year, and many of the brooks are swallowed up in the sand. As the sea is approached the rivers become more abundant. The Dallul Mauri near Ilo, though, is broad even in the dry season, and has a depth of more than 13 feet. But none of the affluents even in the lower course is of any great size, except the Benue.

Climate.

The observations recorded by explorers have been made in such limited areas and for such short periods that no exact and complete account of the climate can be given. It may be said in general terms that the

[1] *S.G.M.*, vol. ii. p. 590.

climate of the bend of the Niger is determined by a dry season with northerly winds and a wet season with rains and storms coming from the south, and that the region of the Niger is a country of well-pronounced monsoons. During the northern summer the burning Sahara is a centre of low pressure, and the winds from the Atlantic blow from south-east and south-west to the north and north-east, bringing with them clouds which part with their moisture on coming in contact with the flanks of the highlands. This is the season of rains. In the winter the movement is reversed, the ocean being then warmer than the land, and the north and north-east winds blowing from the land carry no clouds. It is also certain that the rainfall diminishes from south to north and from west to east, as the clouds part with much of their rain on the mountains of the coast. Naturally the rains set in later also in these directions. While they begin at Konakry and Tiassalé at the end of May or the beginning of June, they do not reach the hinterland of Dahomey and Gourma much before August. Toutée says that two climates prevail in the Niger basin, the equatorial and the tropical. The former obtains almost to the eighth parallel, and has two wet and two dry seasons, while the other embraces a zone of about 10 degrees, and has only one wet and one dry season. The axis of the latter is the thirteenth parallel, along which rain falls almost daily from June to October.

As to the temperature, few observations have been recorded. Explorers seem to have taken it as a matter of course that the temperature of Western Africa is hot, and therefore have not thought of remarking on it. The temperature appears to be lower in the rainy season, owing to the constant humidity of the air, than in the burning desert winds of winter. But this damp heat is more difficult for Europeans to endure, whereas the dry season is decidedly more healthy. Moreover the nights are fresh. The Decœur expedition recorded 48° F. near Parakou at midnight towards the end of November, and 50° to 53½° at about two o'clock in the morning on December 7th.

General Aspect of the Country.

The coast of the Gulf of Guinea is well known to be sandy and skirted by numerous lagoons. From Fresco, however, as M. Pobéguin has lately discovered, it assumes quite a different character, rising in cliffs of 100 to 160 feet in height, and sending forth promontories 200 or 300 feet into the sea. The plateaus above are clothed with oil-palms or covered with plantations.

The general causes that determine the aspect of the country are distance from the sea and the proximity of rivers. The arboreal vegetation decreases with the distance from the coast; first come giant palms intertwined with creeping plants, then copses without high timber, and, lastly, Guinea grass ten feet high and regularly burned.

The highlands of the Fouta Djallon are clothed with timber and fruit-trees, and cultivated lands occupy the valley bottoms and extend up the flanks of the mountains. The abundant rainfall and the influence of elevation have accomplished the miracle of collecting in these highlands

the products of the temperate zone and the rich vegetation of the Tropics. Among the innumerable useful plants are indiarubber, coffee, cocoa, copal, kola, oil-palms, rice, etc.; and of the fruits may be mentioned the orange, lemon, mango, banana, monkey bread-fruit, papaw, coconut, bread-fruit, alligator pear. Several kinds of vegetables are grown, including those of Europe, such as asparagus and potatoes. Valuable wood is abundant, including ebony and mahogany. Agriculture is yet in its infancy, and therefore the enormous wealth contained in the soil of Fouta Djallon is not properly developed.

The aspect of the country on the great plain which extends between the coast and the edge of the forest is not greatly different. Immediately behind the sandy shore and the lagoons begins the region of plantations and groves of trees. The predominant tree in all the country of the Cavally and Comoë is the oil-palm, which is found in a narrow belt of twenty miles along the coast, and yields the only commercial product. On the banks of the rivers the mahogany does indeed grow, but the natives pay little attention to it, and cocoa-palms are seen near the rivers, and between these woods and thickets the natives plant their fields of manioc and rice. The yam, maize, sweet potatoes, cotton, and millet are grown in this region, and lemon-trees, mangoes, bananas, and other tropical fruit-trees are planted in rows on the fields.

The forest, with a varying breadth from 55 to 180 miles, follows an undulating line, sometimes deviating northwards and sometimes bending considerably to the south. This wall of almost impenetrable verdure leaves here and there a way open for the passage of rivers or for the paths that wind through it on their way to the north. In the region of the Sassandra and Cavally the forest belt has a breadth of 170 miles, but it is not so gloomy and compact towards the east. North-westwards it spreads out in a fan, with two or three parallel lines enclosing between them extensive clearings, where the natives have laid out plantations. From year to year the forest retires more and more before the cutlass and axe of the European, or fires lighted by the natives, and in the last five years especially the fields have gained on the woodlands.

Beyond the forest and in the region lying between the outermost skirts of arboreal vegetation and the Niger is a country which, rich and productive when cultivated, does not yield crops spontaneously, but demands the labour of man as much as the soil of temperate climes, and wherever a village has been abandoned or labour becomes scarce in consequence of war or famine, brushwood, tall grass, and sometimes almost the bareness and sterility of the desert, spread over the fields. Mahou, for instance, well watered and fertile, produces rice, ground-nuts, yams, and cotton in abundance, and indiarubber grows wild, but towards the east the plantations thin out. Between Save and Ocpa there is not a village, not a cultivated field, though zones of fine forest lie on either side, while the country between Savalou and Odoua has a smiling aspect. At Djebiga the land is waste, dotted over with thorny mimosas, and between Ogoudou and Salaga (Salougou ?) it is bare and desolate in the dry season, simply for want of cultivation. North of Kong also the country is most dreary and monotonous.

Towards the north the vegetation is less luxuriant. In Gourma the trees are wide apart, the crops more scanty, and pasturage of short hard grass predominates. In Gourounsi there are no tilled fields, the villages are rare, and the bush tropical. It has the climate of the south, with its rank vegetation, while Mossi is covered with villages and is a land of agriculture and grazing; fields of sorghum, cotton, and indigo are seen in every direction. At Yatenga, still farther north, the surface is like a green sea. In Liptako, with its fairly dense population and a few streams, the soil is fertile enough to produce two kinds of millet, maize, and ground-nuts, while between Mossi and Gourma extends a tract absolutely deserted for many years, where water is not to be found during nine months of the year, the wells no longer exist, and the paths have disappeared.

While the zones of vegetation are in general distinctly bounded by lines running east and west, and the luxuriance of the vegetation decreases from south to north, an exception to this rule is presented by the river courses. This fact has been observed along the Cavally and Sassandra and on the Bandama, where the trees grow in dense masses and plantations flourish. The Ocpara is bordered by superb vegetation, while the neighbouring plains are dry and desolate. Still more striking is the influence of the Niger on the fertility of the country it flows through, and French travellers have compared it to the Nile.

At Toulimandio lofty timber with beautiful dark green foliage clothes the banks. Gradually the woods grow thinner and the trees diminish in size, till at Sansanding great plains intervene, with woods in the background—a park-like landscape—while at Saraféré the tangled tropical forest makes its appearance again. From Timbuktu to Say the left bank is certainly sandy, with only a few thorny shrubs, but the right bank, thanks to the fertilising waters of the river, yields abundant harvests. Bamba is noted for its wealth, and produces millet, tobacco, cotton, indigo, vegetables, etc. Here and there grow indiarubber, guttapercha, tarmarinds, and baobabs; but a few miles from the stream the steppe commences. At Gao the kola-nut is seen, and at Ilo there is a forest of hard-timbered trees very suitable for boats and buildings.

The Fauna.

The distribution of the fauna is governed by that of the vegetation; in the south the savage animals of the tropical forest, in the north the peaceful denizens of pasture lands. In all the rivers hippopotami are numerous, and elephants abound in the recesses of the woods. Lions are disappearing, but panthers are frequently met with, and the chattering of monkeys is a familiar sound. Troops of antelopes and gazelles roam over the flanks of the Fouta Djallon mountains and beside the banks of the rivers.

The country is extremely rich in domestic animals, but they are more common in the north than the south. The fauna, like the flora, becomes poorer from Liberia to Timbuktu. In the basins of the southern rivers it is equatorial; neither horse nor dog exists here, and to find

oxen one must go as far north as the Bariba country. Consequently, until railways are constructed, the transport of goods must be left to porters. Farther north the horse can live; a few oxen and asses have been imported into Borgu by the Hausas, and Bani has great resources in its asses, horses, zebus, and sheep. The plateau of Mossi also feeds immense herds of zebus and long-woolled sheep guarded by Foulbé shepherds. The horses and asses of Mossi are famous throughout the Sudan. Liptako is extending its pasture-lands, and all along the Niger grazing is pursued—in Ségou, Dia, Macina. Apiculture yields large quantities of wax and honey in the centre of the bend of the Niger; to the north the ostrich furnishes valuable feathers, and north of the Niger the camel appears.

In the mountains of Fouta, among the trees of the forests, and on the banks of the Niger there are pigeons, guinea-fowl, pelicans, ducks, and many other birds. The rivers swarm with fish; the Bandama contains them in large numbers, the Cavally supplies all the inhabitants of its valley, and the Bosos take marvellous catches in the Niger. Termites abound, and flies dangerous to cattle, though not so deadly as the tsetse; and the jigger has been introduced from Brazil.

Industry and Commerce.

The mineral resources of the country have not been properly investigated. The inhabitants of the Bandama valley use small bags of gold dust as currency, and it appears certain that an auriferous belt extends from the lower Sassandra by the valley of the Bandama to the banks of the Niger; the upper valleys of this river also contain gold. Iron is abundant in the clay, Pobéguin found a specimen of copper pyrites near Grabo, and Félix Dubois has reported the occurrence of antimony in Hombori. But from the vague notices that have been received it would be rash to conclude that the country will ever derive any great part of its prosperity from its minerals.

A few rude industries are carried on locally. A few natives mine gold, some extract oil from the palm, there is a certain number of tanners, a considerable number of weavers, and a fair proportion of dyers, who manufacture and dye the scanty clothing needed in these latitudes, and the iron industry is very active in one or two places; but agriculture is the main occupation.

Caravans, crossing the bend of the Niger, transport from south to north and from west to east a certain quantity of goods. It is to this traffic of the Hausa and Fulla merchants that Kong, before the incursions of Samory, and that Bouna and Kouandé still, owe their importance. They carry cloths, gold, ivory, indiarubber, ostrich feathers, and kola-nuts. In the south, the commerce of the Sassandra is exclusively confined to oil and palm kernels; ivory comes chiefly from the region between the Bandama and Férédougouba, between lat. 7° and 9° 30′ N. In Gourma the kola-nut gives rise to an active trade. On the Upper Niger vegetable butter and ostrich plumes are the chief commercial articles. Destenave and Baud report that the market of Dori is fre-

quented by the people of Oudala and by Tuaregs from Gao, bringing salt, sheep, oxen, mats, and dyed skins: by Hausas from the south-east and Sokoto, bringing turbans, black and dark blue loin-cloths, bonbons, pyjamas, English beads: by the Mossi, with Mossi cloth and copper bracelets (the metal is of English or German origin), tobacco, all-spice, onions, honey, and kola-nuts. To the market of Gambaka come the merchants of Kong with their textiles, those of Bondoukou with gold, of Kintampo with kola-nuts. Salt is perhaps the most important of all the articles of exchange, and the most profitable to the caravans which import it, being more precious than gold or ivory to the peoples who are deprived of it. With kola-nuts, it forms the basis of the commerce of the Sudan with the adjoining countries.

Commercial Routes.

As the kola-nut grows only in the south, and salt comes down from the north, the caravans circulate more to the north and south than east and west. Certain European goods, such as knives, woven materials, arms, etc., are much sought after by the natives, and these are brought northward from the coast. One of the chief routes runs from Tiassalé across Baoulé to Gouropan, where a branch diverges to Elengué and Seguéla, probably crossing the upper Sassandra to the Cavally, while the main road continues northward to Sakala. Other routes connect Tiassalé with Bouna and direct with Kong, the centre to which the routes of this part of the Niger territory converge. Again, from Sakala the caravans travel northwards through Tiémou and Tengréla to the Niger, or more westerly through Kani, Koro, Beyla, and Kissidougou. From Bouna a route runs through Wa to the great market of Ouagadouga (Wagadugu), and finally reaches Djenné and Mopti.

In the eastern part of the Guinea lands there is also a system of routes. As in the west, here also it is directed towards the Niger. From Grand Bassam and Bettié a route passes through Assikasso across British territory to Salaga and Yendi, and thence to Sansanné-Mango, an important centre, to which come the goods of Gourma and the Hausa caravans from Kouandé. Eastwards lies Maka, where the caravans start for Ilo and Gomba, and for Kandi, a focus for caravans coming from Gandu and Sokoto. A less important stream of commerce extends from Carnotville through Nikki and Kishi. Such are the most frequented routes, but, of course, there are many others connecting the various districts with the nearest centres of trade. All these routes are, however, only paths on which the porters follow one another in Indian file.

The navigability of the rivers has already been briefly mentioned. The Niger could probably be navigated by steamers, during part of the year at least, from Kouroussa to Toulimandio, 250 miles; from Koulikoro to Ansongo, 990 to 1050 miles; and from Geba to the sea. The Sassandra will probably never be of great utility; the Comoë affords a waterway for canoes in certain sections, as from Alépé to Attakrou; and the Ouémé was used by gunboats, barges, and tugs during the war with Dahomey, but the gunboats did not pass Abomey, though it was the

season of floods, and it is very doubtful whether navigation can ever be extended far up this river.

M. Camille Guy also discusses railway communication, including the great Trans-Saharan railway. It will suffice here to state what has been accomplished, or has a fair chance of being realised within no very long period. The line from Kayes on the Senegal is year by year approaching the Niger, and within five years trains will arrive at Toulimandio. The productive districts of Fouta Djallon and the upper district of the Cavally will be served by the railway shortly to be commenced from Konakry to Kouroussa. A railway has also been proposed to Kong, and some preliminary studies have been made; probably the first section will follow the right bank of the Comoë from Alépé to Attakrou.

THE NEAR EAST.[1]

Mr. Miller has produced a book which for its practical importance ought to be in the hands of every serious British politician. Time was when, earlier in the century, the only records of the Balkan lands (with one or two notable exceptions) were written by British travellers—leisured and cultured men like Leake, Hobhouse, Urquhart, Muir, Evans. But, owing to that apathy which for long now has characterised our Foreign Office and our merchants alike in that part of the world, we have fallen behind. The meagreness of the literature gauges pretty well the interest being taken. And yet where else in the world is there such a mass of prepared material, in the shape of many more than semi-civilised races, waiting to receive and anxious to adopt our Western ways and products? The historical, ethnological, geographical, and commercial interest of those lands is inexhaustible. The Balkan peninsula is like a big roomy cupboard into which all the waifs and strays of Europe, and many of Asia, have been thrust, and left to work out their own salvation —which involves the solution of the Eastern question. It is probably owing to the fact that the Balkan peoples have been regarded by the British public as outer barbarians and their lands as desolate wastes, that, in comparison, Africa, Australia, and China even are better known to us, and evoke our enterprise more readily, than the Balkans. But others are rushing in to do what we ought to have been the first to do or that we have ceased to do.

As early as 1885 and 1888 the present reviewer called attention to the grand openings for British trade there and in near Asia Minor; but his and other voices since have been mere cryings in the wilderness. Mr. Miller has done well to publish such an elaborate, detailed, and careful record of his observations in those regions. His book can hardly be called literature—perhaps it savours too much of the official report for that—but his observations are keen and clear, and in all matters that come beneath his own eye, his judgment is just and impartial. He com-

[1] *Travels and Politics in the Near East.* By William Miller. London: Unwin, 1898.

bines in a rare degree the power to see things truly on the spot and to assign their proper value and place in the whole problem. He is never far wrong when estimating or criticising the policy of a State or the atmosphere of a court; but he often seems to forget that the pace has been very much forced in all those States and dependencies, and that usually the spirit of the people is a very different thing from the policy of the court or the camp.

If he had travelled more in the interior than he seems to have done, and followed less the beaten tracks (although none of his are beaten in the usual sense), he might have been less confident in his conclusions. For, as "Paris is not France," so Athens is not Greece, Sofia not Bulgaria, Belgrade not Servia, Austro-Hungarian officialdom not Bosnian nationality, the Yildiz Kiosk not the Turkish people. Possibly on that account he minimises the penetrative contagion of Greek civilisation, the adhesiveness of the Moslem elements, the known and felt affinity of all the Slav-speaking races: possibly he underrates Russia's power and chance for the future, and overrates Austria's.

But of things as they are, to all appearances, as seen in journeys from centre to centre, he gives a faithful and wise report. He speaks with full knowledge of all political matters—thanks largely to his interviews with high personages. He could not have said a truer word than that politics is the curse of Greece, Bulgaria, Servia, nor than when he deprecates the too rapid increase of higher education as developing a danger to the State in fostering social discontent. His general estimate (last chapter) of the various forces at work, and of the various ideals entertained as possible solutions of the Eastern Question, is very fairly put. Dismissing alike the idea of a great confederation of the native States and of a reformed Turkey, and of a resuscitation of either the old Serbian empire of Dushan by the Serbs, or the old Bulgarian empires of Simeon and Samuel and John Asên by the Bulgarians, or the old Byzantine empire by the Greeks, he inclines to a European protectorate or occupation—presumably by Austria in the west down to Salonica, and Russia in the east down to Constantinople.

He rightly laments that we British are now weak there, where once we were strong. Nevertheless, almost all those States still look to us above all others for support, and believe in us as *the* champions of independence. If once outside pressure were removed, it is *language* that would decide how each State would form its boundaries—and probably five or six States would be the result. At any rate, only along the line of independence shall we have peace and content in the Balkans. Racial feelings are everywhere very strong, and on the whole language denotes the race.

It is in his acquaintance with the home sentiments and condition of the people—the man in the street, the peasant in his hut, the shepherd on the hills—that Mr. Miller seems to come most short.

With regard to *Dalmatia*:—Having visited only the littoral, he falls into the common error of assuming that all behind to the Dinaric Alps—from Otočač to Knin and Sinj and Metkovič—is similar thereto. Zara, Sebenico, Spalato, Ragusa are indeed more or less Italian in appearance,

but at heart Slav; but inland, even the appearance no longer exists, the Italian language is hardly known, and, what is strangest of all, the tribal or racial feeling of Dalmatian distinctness from the Slavs of Bosnia and elsewhere is dominant. In Spalato and Ragusa, where the Italian element is stronger than elsewhere in Dalmatia, the discontent with Austrian rule is deepest—the prevailing question being, "Why have we so little done for us, and Bosnia and the rest so much?"

With regard to *Montenegro*:—It is true that here Austria and Russia meet. But even in Montenegro there is another party and a powerful, which prefers the old idea of Serbian rule, and will have none of either Russia or Austria. While it is true that Austrian influence hems in the Black Mountain (*Črnagora*), it must be remembered that that is only by alien garrisons and diplomacy, not by the sympathy of the people either in Herzegovina, Novi-Bazar, or even Albania. The Slav populations generally are tolerant of Austrian rule, nowhere enthusiastic about it—least of all round about Montenegro. Too much has been made, also, of the Hospodar Nicholas. He rules, but he is not Montenegro, as we shall see when the Crown Prince comes in to the succession—and Montenegro will fall into line with the other Serbs, or perish.

With regard to *Bosnia and the Occupied Territories*:—All must allow that Austria and Baron Kallay deserve great credit for the splendid work done here—second only to our own in India and Egypt. No other nation, except our own, has laid the world under so deep a debt as Austria-Hungary for wise, honest, and enlightened administration of subject peoples, and prudent dealing with their racial and religious susceptibilities. A strong, united central government will continue to work wonders, and may even push on through Novi-Bazar to the the Ægean. But the question is, "Can Austria bear such a burden? is she intrinsically fitted to accomplish her Balkan projects?" There is room for doubt. She is not loved. At any rate, Novi-Bazar at present, with its 100 miles of rough mountain barrier, keeps her out; and Europe ought to be consulted before she goes farther south.

Mr. Miller is inclined to place rather much to the credit of Austria. For instance, Čajnică, Jajče, Travnik, Banjaluka, Serajevo, were always beautiful spots, and it is their *Turkish* character that still constitutes their charm. The people may be grateful to Mme. von Kallay, but Vilma, not that lady, is namesake to fountains. Vilma is a Slavonic nature-spirit, haunting clouds, woods, fountains. From Velebič (Croatia —Dalmatia) to Ochrida (Albania—Macedonia) Vilma (or Vila) is thus revered. It is not in Herzegovina only that the Bogomiles have left plentiful traces. All over the old Bosnian lands (from the Save to Scutari lake) their monuments are found singly or in groups. They were Cathari rather than Paulicians (p. 439)—anti-clerical, mystics, dualists, a curious blending of Asiatic and European ideas on a Christian basis. It is strange that Mr. Miller mentions so few of their stones.

His journey down the Drina on a raft to Višegrad and over the hills to Serajevo is very vividly told. That and his visit to the Shipka pass and Samakov and his description of Corfu life are the best bits of writing in the book. But his pages are everywhere replete with interest and must impress even the untravelled reader with the truth of his representation.

With regard to *Greece* :—His strictures are severe but justified. From the king to the newsboy there is everything to criticise, and little to commend. His remarks about the whole Greek constitution and modern style of life are pointed and true. Greece sadly needs a protectorate over herself, and is ill fit to exercise such over Crete or any other place. What has hurt America has well-nigh ruined Greece, viz., the *συναλλαγή*, giff-gaff, or log-rolling. Mr. Miller brings out this corrupt system of giving and getting favours according to political partisanship most strikingly in his estimate of the various premiers and statesmen. The king is the only one that has benefited continuously by it, and his consistent minding of his own money interests is the chief cause of his unpopularity. Karapanos, another great financier (a cultured and clever man) did not make his money in Greece but in Turkey (in tramways and suchlike concerns in which the Sultan favoured him). Greece is too small for so many clever aspiring men, and what she wants is technical education, wherewith to develop her own natural resources, and leave politics and soldiering alone. It was known to more than the editor of the *Akropolis* in and before 1894 that the condition of the army was base and unsound. It was easy to prophesy from what was before one's eyes. The present reviewer was in the street that day the officers sacked the printing office, and nothing was clearer proof of the *general* corruption than the fact that the culprits were acquitted, though half of Athens saw them commit the outrage. But there is a better side to Greek life than politics and German-modelled Athens with its blinding glare, viz., the simple habits of the people in all rural districts. As great as is the contrast which Mr. Miller remarks between the *εὔζωνοι* (kilted) and the ordinary puny soldiers, is that between the countryman and the townsman. Less centralisation and more agricultural development can alone put Greece on a good footing. As Crete (p. 346) is not merely "four or five harbours and coast-towns," so Greece is not Athens and a few seaports, but a land of industrious farmers, sturdy shepherds, hardy seamen, busy, clever merchants. The Germans know that, and are reaping the benefit, which we have failed even to realise.

With regard to *Bulgaria* :—There can be little doubt that the Bulgarians, being stolid and practical, well set upon the earth, are likely to advance yet, and to inherit most of the eastern part of the peninsula, all Thrace, and much of Macedonia. How far Macedonia is Bulgarian in race it may be hard to determine, but the language known as *Bulgarski* is that most spoken by the common people to far beyond Monastir and Ochrida (going west), and to the gates of Salonica (going south).

Mr. Miller is very interesting when telling his experiences in South and Central Bulgaria—the Shipka Pass, Plevna, Samakov—and right in drawing attention to the richness and beauty of the land. But he should not imply that primitive accommodation and insect-infested rooms are peculiar to Bulgaria. All over the Balkans in the interior (especially where there are no Greeks) one experiences the same. There is much to censure in the Bulgarian character—their boorishness and sauciness—but one may not fairly compare them (for lack of manners or dignity) with the Montenegrins or Albanians. The latter have been shepherds, hunters, and warriors, while the former have been agriculturists and serfs from

the earliest times. There is certainly no use in putting the whole blame of their defects on the centuries of Turkish lordship. These surely were there long before the first Turk entered Europe—as racial characteristics, having their counterparts in the Serbs of Servia, Bosnia, and Montenegro—and, developing in new ways under the pressure of Western fashions, will be there long after the last Turk has left Europe—to aggravate a new but not less perplexing Eastern Question.

Towards the end he deplores the loss of picturesqueness and individuality through the adoption of Western ways, and surely he is right. Many of the places he praises in Turkey have always been praiseworthy, and their pleasing effect on the visitor cannot entirely be attributed to Western "improvements."

We cordially recommend this book as being, in its scope and general accuracy, the best by far yet published on this vast subject.

HUGH CALLAN.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

LECTURES DELIVERED IN MARCH.

ON March 16th, Mr. G. E. H. Barrett-Hamilton, one of H.M. Commissioners to the Bering Sea, addressed the Society in Edinburgh on Kamchatka. The Earl of Moray presided.

Another meeting was held on March 28th, when the Rev. Hugh Callan delivered a lecture on "Albania and the Albanians in 1898." Mr. J. R. Reid, C.I.E., took the Chair.

Mr. Callan lectured also to the Glasgow Branch on March 27th.

Two meetings were held in Aberdeen during the month. On March 7th Mr. Savage Landor addressed an audience of members of the Society and of the Association of Teachers of the Secondary Schools of Scotland (Aberdeen Branch); and on March 30th Mr. Callan read a paper before the Aberdeen Branch of the Society, Mr. Spence presiding.

LECTURES IN APRIL.

Mr. Albert B. Lloyd will deliver a lecture entitled "From the Mountains of of the Moon to the Congo," on April 6th, at 8 P.M., in the Queen Street Hall, Edinburgh. Professor Prothero will preside at the meeting.

GEOGRAPHICAL NOTES.

By THE ACTING EDITOR.

ASIA.

The Country east of the Dead Sea.—P. Giuseppe Manfredi, a missionary in Jerusalem, has compiled a map of the region which is reproduced in the *Boll. della Soc. Geogr. Italiana*, February. The maps now existing are in many details incorrect, according to P. Manfredi, the country having been closed to travellers, other than missionary, up to 1893, when the Turkish Government took possession of Kerak, previously independent. Since then the Beduins of the neighbourhood

have been brought more under control, and Europeans have begun to penetrate into the country. The western part is rather mountainous, forming the flanks of the immense depression at the bottom of which lies the Dead Sea; the rest is a plateau at a height of 2600 to 3300 feet above sea-level. It is exceedingly fertile but bare, and cultivated only in small patches with wheat, barley, and lentils, and a very little durra and sesamum. The population does not exceed twenty millions; the town of Kerak has 10,000 inhabitants, and Mâdeba 1000. The rest are all nomads, chiefly pastoral and possessing innumerable herds of camels and sheep.

The Products of the Philippines.—The position of the islands, extending over sixteen degrees of longitude, and their abundant water-supply are favourable to the growth of agricultural produce. But the want of labour, added to the obstacles raised by the Spanish administration, have seriously hampered industrial enterprise, so that the land under cultivation is of relatively small extent.

As well as tropical plants, those of the temperate zones, such as wheat, barley, and potatoes, flourish here. Probably the vine could be grown, and tea has been tried successfully, but only to a small extent, for extensive plantations can hardly be made to pay in the absence of railways, roads, and labourers. The principal products exported are sugar, Manila hemp and tobacco, and, to a small extent, coffee, the cultivation of which has greatly decreased of late. Indigo, sapan-wood, and copra may be expected to take a more prominent place in Philippine trade than at present. Rice and maize are grown only for home consumption, and the supply of the former has to be supplemented by imports from Bangkok and Saigon, though the fertile soil would yield all that is required, as well as cocoa which now comes from Java. Formerly rice was exported from the islands, and the decline in its cultivation is due to the wretched administration. The best tobacco is raised in the valley of the Rio Grande de Cayagan, in the north of Luzon. The north of the island is cut off from the rest by a range of high mountains, running from the Gulf of Lingayen to the Pacific, the Caraballo, over which there is no road, but only a path and a telegraph line. The tobacco is, therefore, sent down the Rio Grande on boats to Aparri, and there shipped for Manila. The plant is also grown on the west coast of the north-western part of Luzon and on the Visayas, but there it is of inferior quality, and is mostly exported to Spain.

A world-famed article is Manila hemp, the fibre of the *Musa textilis*. Though many species of *Musa* are found in warm climates, the *Musa textilis* appears to thrive best in the Philippines, and attempts to grow it elsewhere have always been unsuccessful. The finest quality is produced in the volcanic and rainy districts, particularly in Camarines Sur, Albay, Samar, Leite, Marinduque, Cebu, as well as in Negros and Mindanao. The fibre is in the petioles, from which it must be taken before the plant flowers, or it loses elasticity and lustre. When two or three years old the plant is cut down, and the bast strips are torn off lengthwise or the petioles are separated singly, and the inner membrane with the pulp is removed. The bast strips are then drawn under a knife to scrape away any pulp remaining in them, and are then dried in the sun. The loss of fibre due to this primitive process might be avoided by the use of proper stripping-machines. From the current sorts ships' cables and miners' ropes are made, and, in America, grain-binders for harvesting. Early in the century the price was $4 to $5 a Spanish picul (140 lbs.); it rose up to $11, and in 1890 was artificially forced up to $17. Of late it has been $6 to $9, and in April the ton was sold in London at £19. The chief consumers are Great Britain and the United States, the former taking over 50,000 tons, or rather more than half, a great part of which is sold again to the Continent.

The archipelago is very rich in timber, and exportation was once very large;

no new plantations have ever been thought of. A regular, though small, export trade is done in sapan, a dye-wood. According to the Spanish authorities, only one-tenth of the arable land is under cultivation, and this is too high an estimate. Cattle-breeding has been carried on by half-breeds for many years, but of late it has been found more profitable to import the cheap Queensland cattle. Sheep would probably do well in some provinces. There are few goats, while swine and poultry are very abundant, the flesh of the former being a favourite article of diet with the natives. The horses, small but tough, resembling those of Java, and the black buffaloes, have been imported by the Spaniards. The buffalo is employed for working pumps and sugar-presses on the plantations, for draught and other purposes.

Coal, iron, gold, silver, copper, etc., are found in the islands, and lately petroleum has been struck. Coal was discovered in Cebu in 1827, and subsequently in Negros, Mindanao, Luzon and many other islands, and it is probably spread over the whole archipelago. The coal of Cebu is of the best quality, equal to Newcastle coal. In Albay a seam runs for a long distance at a depth of five or six yards. Small workings were opened, but under the Spanish Government capitalists, especially foreigners, did not dare to finance such undertakings, and up to the present coal has been imported from Australia and Japan.

Iron has been found in many of the islands. The best is that of Luzon, in the provinces of Morong, Laguna, Bulacan, Nueva Ecija, Pampamga, and Camarines. The ore contains seventy-five to eighty per cent. of pure iron, and occurs in the midst of forests, so that a plentiful supply of fuel is at hand. It is only exploited by the natives to a very small extent. The best quality of copper exists in Luzon, in the district of Lepanto, but the ore is found in other provinces and on Masbate. Mines were worked in Lepanto up to 1875, when they were closed from want of labour. Gold probably occurs in all parts of the archipelago; the best known sources are in Camarines Norte. It has also been reported from Mindanao, Mindoro, and Panay. From 1893 it was the object of much rash speculation which was fortunately put a stop to by the war. Galena was discovered in Cebu at the beginning of the seventies, and in Mambulao and Paracale the deposits are probably very rich, but all attempts to mine them have been abandoned after a short time, probably owing to insufficiency of capital. Sulphur is naturally abundant in a volcanic country, and alabaster, marble, and granite may also be obtained; the last is quarried on the Bay of Mariveles, opposite Manila.

Cigar manufacture is the only industry of importance. The extraction of ilang-ilang essence deserves mention, simply because it is peculiar to the Philippines. The essence is made from the green blossom of the ilang-ilang tree (*Annona odoratissima* or *Cananga odorata*), and finds its way principally to Paris, where it forms the basis of all the finer perfumes.

The traffic between Manila and the provinces is carried on mostly by thirty-five steamers, and a large number of smaller sailing vessels. The only railway runs from Manila to Dagupan on the Gulf of Lingayen, the port of Pangasinan, a rice-growing province. Foreign vessels have always taken the greater share of the trade, in spite of the privileges enjoyed by those under the Spanish flag. In 1897 the foreign ships entering Manila were 204, with a tonnage of 301,199, while the outgoing vessels numbered 197, with an aggregate tonnage of 292,219. The Spanish vessels numbered only 48 and 50 respectively, with tonnages of 84,326 and 88,649. At the commencement of the century the imports greatly exceeded the exports, while in recent years the latter have been about thirty per cent. in excess. In 1896 the exports were valued at $32,771,500 (about £3,277,150). Heavy duties and fines, most of which found their way into the pockets of the

custom officials, and other vexatious regulations have hitherto cramped trade, but these obstacles will now, of course, be removed.

It is of great importance that good roads should be made to open up the country, and that the navigable waterways should be controlled. Of railway routes, the most important runs from Manila through Nueva Ecija, the Caraballo mountains, and the province of Nueva Vizcaya to the Rio Grande de Cagayan. A branch from the existing Dagupan railway to the proposed naval port, Subig, has been decided on. A railway from Manila *viâ* Mariquina to Antipolo would be of great advantage to Manila itself. It would run through a well-populated country, which supplies the capital with agricultural produce and articles used by the native population, and after twenty miles would reach Antipolo, which, lying on the western spurs of the cordillera, enjoys a cool, agreeable climate, and would be a very suitable health resort.

Manila stands at the mouth of the Pasig, the river by which Lake Bay discharges into the Bay of Manila. On the left bank of the river is the fortified quarter, inhabited by monks, officials, soldiers, and a few shopkeepers. On the right bank is the unfortified part, where the chief business is done, and where foreigners have their stores and warehouses. The population is given as 300,000, but no proper census has ever been taken. For a tropical town Manila is healthy, though fevers do occur. Cholera has been banished by the excellent supply of water which comes from Santolan, about nine miles off. Life is very agreeable in the Philippines, especially in Manila, where there are comfortable houses, and no lack of recreation.—Max. L. Tornow, in the *National Geographic Magazine*, February.

AMERICA.

The Stikine River.—Miss E. R. Scidmore, one of the editors of the *National Geographic Magazine*, visited the river last year (see the number for January), when there was a rush of miners to Klondike along the Teslin route. Fort Wrangell was crowded by gold-seekers landed from the ocean steamers, land rose to absurd prices while the excitement lasted, and for a few weeks a dozen light-draught stern-wheel steamers plied along the river to Glenora, crowded with passengers.

The international boundary has moved up and down stream during the last thirty years, and in the summer of 1898 the United States were temporarily represented by a custom-house in a tent on the river bank a few miles above the Popoff glacier, near the great bend, while a few rods farther a detachment of Canadian mounted police was stationed. The Iskut river enters from a long deep valley on the south, which is said to present finer scenery even than the Stikine. Grizzly, cinnamon, and black bears are said to abound here, as few sportmen come this way. Mountain sheep, goat, deer, and elk offer great temptations to the big-game stalker who is ready to endure the plague of mosquitoes and gnats. From Orlebar glacier to the Little Cañon the Stikine presents a most splendid panorama. Glaciers are everywhere, and it is easy to believe Dr. John Muir's statement that he counted one hundred from his canoe and three hundred during climbs ashore, all draining into the Stikine. The Little Cañon extends for a quarter of a mile, with sides rising perpendicularly for nearly a hundred feet and then sloping away to wooded foot-hills, beyond which towers the Sawback range, the continental watershed. The foaming water between jagged rocks, 60 to 100 feet, was running with a comparatively gentle current—only a little over ten miles an hour—on the day Miss Scidmore ascended in the *Ogilvie*, and with full steam the boat was able to pass up the cañon in thirteen minutes. In flood time steamers were forced to wait

or be hauled up with wire cables fastened to the largest trees on the bank. The Kloochman's (squaw's) Cañon is only a stiff millrace, and the Big Riffle is but a stretch of dashing rapids. Green terraces and open grassy stretches were then seen, and the log-houses and buildings at Hudson's Bay Flats, or Shakesville, were reached. A signboard on the banks marked the terminal point of the future Cassiar Central railway. Two miles beyond, Glenora, a row of log-houses along the river bank, was then enlarged by a large encampment. In the spring of 1898 it had been galvanised into new life, but when the difficulties of the boggy Teslin trail became known the disappointed fortune-hunters turned back, some of them to try other routes to Klondike farther up the coast, and provisions, horses, dogs, tools, etc., were all for sale.

The current is very swift between Glenora and Telegraph Creek, twelve miles higher up the river, where the Teslin trail strikes northward. Above Telegraph Creek the Great Cañon of the Stikine extends for fifty miles, a deep gorge with terrific rapids and sharp turns.

During the night the *Ogilvie* stopped at Glenora the river rose five feet in consequence of rain in the Dease Lake country, and floated the steamer across the little wharf to which it was moored. The return voyage of 125 miles to Fort Wrangell was accomplished in seven hours, the Little Cañon being shot in less than three minutes.

Geodesy in the United States.—In *Science*, March 3rd, Mr. E. D. Preston, of the U. S. Coast and Geodetic Survey, gives a few details on the work accomplished by his department. Since 1832 two hundred and three base-lines have been measured, of which nineteen, on account of their accuracy, length, etc., may be classed as primary. Their average length is 9892 mètres (10,818 yards, or a little more than 6 miles), and the probable total error is about 1 445,000 of this length. A new form of base apparatus, named the Duplex, has been designed by Mr. William Eimbeck. It consists of two bars, brass and steel, each five mètres long, so arranged that the measurement may be made with each component separately and simultaneously. The Salt Lake base was measured in 1896 with a probable error for either component of less than one five-millionth of the measured length.

The shore-line of the United States, 5452 miles in length (exclusive of Alaska), has been covered by triangulation, with the exception of a few hundred miles on the north-west coast. An oblique arc of 22 degrees has been measured from the north-east boundary in Maine to the south-west limit of Alabama, and an arc of 49 degrees on the 39th parallel, from the Atlantic to the Pacific, has been completed. All the New England States and a large part of the middle ones have been covered with triangulation, besides considerable areas in the south and west. The greatest triangle has sides of 133, 167, and 190 miles, and the highest station is 14,000 feet. In California the probable error of a direction at any station was 0·081″, while that from the closing of triangles was about twice as much. A fine example of rapid expansion from the base to a fully developed net of triangulation is found in the vicinity of Salt Lake. The average height of the thirteen stations composing the main scheme is 11,256 feet, while the average length of the lines connecting them is 159·734 kilomètres (99¼ miles). The line from Mount Ellen to Uncompagre measures 182¾ miles, and is the longest observed from both ends and forming part of a regular system of triangulation that has been executed by any trigonometrical survey. With regard to the base-net at Salt Lake, it may be mentioned that the base lies 4224 feet above sea-level, and that the mean height of the stations forming the quadrilateral is 11,088 feet. In five steps we pass from a

base of 11·2 kilomètres (about 7 miles) to a line of 237·765 kilomètres (147¾ miles) between Pilot Peak and Mt. Nebo. The quadrilateral in which the base-line expansion culminates, and on which the trans-continental extension rests, contains nearly 10,500 miles, and is the largest yet realised. Its angles are at Ogden, Mt. Nebo, Ibepah, and Pilot, and the probable error of the side Mt. Nebo-Ibepah, depending on angular measurements only, is a two hundred and eighty thousandth part of its length.

Besides the work in practical astronomy necessary for trigonometrical survey, the department has given special attention to other phases of the subject. Star catalogues have been compiled with such care that the probable error of a declination may be given as less than a quarter of a second, and an observer can determine his latitude from twenty pairs of stars in the same evening with an uncertainty of only 10 feet. Thirty-five parties have been sent out to observe solar eclipses in various parts of the world, and the variations of latitude have been observed at three stations, each of which has been occupied more than a year.

Hypsometry, magnetism, gravity, and physical hydrography have also been studied. Five thousand miles of precise levelling have been executed, including four independent determinations of the height of St. Louis, two from the Atlantic and two from the Gulf of Mexico, whence it appears that the surface of the latter is somewhat higher than the sea-level at New York. The exploration of the Gulf Stream has been made a part of the regular work, and the hydrography of the coast has been developed side by side with the triangulation and topography.

A re-survey of Chesapeake Bay, the measurement of an arc through the United States on the 98th meridian, and the development of Alaskan geography are among the projects of Dr. Pritchett, the present superintendent of the department, all which have been carried out during the past two years. The line of trans-continental levels is being pushed westwards, primary triangulation will soon be completed from San Francisco to the Mexican boundary, hydrographic surveys are in progress on the coasts of both oceans, and numerous parties are engaged in the interior. Diplomatic negotiations are in progress to arrange for an extension of the great arcs into Canada and Mexico, whereby an additional meridional arc of about 55° and an oblique one of 33° will be obtained.

The Climate of Mexico City.—Mr. R. Hay Anderson, Corr. Member, has sent us the following meteorological readings, recorded at the Central Observatory during the year 1898. The observatory is situated in lat. 19° 26′ N. and long. 99° 07′ 53·4″ W., and the barometer is at a height of 7472¼ feet above sea-level.

Mean atmospheric pressure, reduced to freezing-point (inches)	23·060	Mean humidity of air, per cent., in shade,	59
Maximum do.,	23·300	Do., in open air,	61
Minimum do.,	22·894	Mean tension of vapour, in shade (inches),	0·317
Mean temp., in shade (Fahr.),	59·72	Do., in open air,	0·343
Maximum temp., ,,	88·20	Mean evaporation of water in shade (inches),	0·111
Minimum temp., ,,	28·40	Do., in open air,	0·308
Mean temp., in open air,	60·44	Days of rain,	164
Maximum temp., ,,	93·20	Rainfall, total amount (inches)	23·284
Minimum temp., ,,	22·28	Greatest fall in 24 hours,	1·241
Maximum daily range in shade,	35·10	Mean amount of cloud (0-10),	5·2
Maximum daily range in open air,	54·72	Prevailing direction of clouds,	SW.
Mean temp. of soil 33·5 inches deep,	60·08	Number of cloudy days,	129
Mean temp. of water, in shade,	55·40		

Number of clear days,	96	Direction of the wind of maximum velocity,	NE.
Prevailing wind,	NW.	Ozone, mean (0-10),	2·8
Mean velocity of wind (miles per hour),	2·90	Number of days on which lightning was observed,	136
Maximum do.,	32·41		

The year was in general normal. The coldest month was January, which is usually the case, but the warmest month was not April, as is usually the case, but May, as the rainfall was greater in April and reduced the temperature.

The prevailing winds were NW., as almost always is the case. The winds of greatest velocity were NE. The year was rather windy.

The rainfall was abundant. In some States of the republic it caused damage, but, in general, the weather was advantageous for agriculture.

There was only one earthquake shock during the year in the city of Mexico. It took place at 9.35 A.M. on June 6th. The movement was oscillatory from NE. to SW., and lasted three seconds. It was unimportant, as are nearly all the earthquakes that take place in the Valley of Mexico.

The Nicaragua and Panama Canals.—Dr. H. Polakowsky reports in *Petermanns Mitt.*, No. 2, the present state of the question. The Commission appointed by the United States Government has visited Nicaragua, and, with the help of some seventy engineers, has thoroughly investigated the whole canal region from ocean to ocean, spending ten months in the work. Meteorological and hydrographical observations have been extended at certain points for a whole year. The Commission holds that the construction of a canal is quite possible. The calculations of the costs for the two best-known routes are nearly completed. These routes are those recommended by the Maritime Canal Company (see vol. xiii. p. 267), and by Lull. In these schemes the rapids of the river San Juan were to be circumvented by canals with locks. The expenses by these routes are calculated at about 124 and 123 million dollars respectively. But the dimensions of the canal are to be much greater than heretofore proposed, in the length and breadth of the locks, in the depth of the canal, and the radius of its curves. The Commission affirms that Lull's route is the better, presenting no troublesome problems to a good engineer, besides which, the canal would be more easily kept in repair. Both routes admit of modifications tending to diminish the expense, and these are being considered by the Commission. Peter C. Hains, one of the Commissioners, while agreeing in general with the conclusions of his colleagues, maintains that the estimates should be increased by twenty per cent., in consideration of the difficulties attending a work of such gigantic dimensions in a tropical country.

It is not yet definitely settled whether the Americans will undertake the work or will prefer to complete the Panama canal. In the former case, the eastern section of the canal will not take the route recommended by Menocal, but will follow the San Juan river to its mouth.

In America, the question is raised whether it is not better to complete the sea-level canal of Panama, of which more than a third is already finished, rather than to construct the Nicaragua lock canal, which will be difficult to keep in repair. It is also a question for seafaring nations to consider whether it will not be advisable to construct the Panama as a competing canal, seeing that a Nicaraguan canal, built by the United States, will be open to ships under the American flag (and perhaps the British) on more favourable terms than to those of other nationalities.

The Panama railway, the property of the new canal company, yielded in 1897 a net profit of $322,523, though the costs of working were twenty-five per

cent. higher than in the previous year. In place of the bad shallow harbour at Panama, another has been constructed at the mouth of the Rio Grande. An iron dam, 300 yards long, has been placed at the end of the mole on to which the trains run, so as to protect the new harbour. Over 8,630,000 cubic yards of material, 196,000 being rock, have been excavated, and the total work, now nearly finished, has cost £244,800.

The technical studies for the canal were brought to a termination at the beginning of 1898, so that all the details can now be fixed. Work is now in progress in the two great cuttings of Culebra and Emperador. In the latter mountain the temporary canal bottom has been sunk to its level along the whole distance, $3\frac{3}{4}$ miles, but in the neighbourhood of the Culebra mountain the excavation has to be carried thirteen feet deeper, for a length of about 600 yards. In the Culebra mountain itself the deepest cutting at present is 165 feet. The highest basin is cut down to an altitude of only 100 feet.

Bello Horizonte.—The Italian Consul at Juiz de Fora describes the new capital of Minas Geraes in the *Boll. del Ministero degli Affari Esteri*, January 1899. Built on the site of the old Portuguese village of Curral del Rey, on the slope of the Serra do Curral, it occupies a pleasant position in the centre of a plateau surrounded by picturesque hills, and being provided with good water, and enjoying a healthy air, it possesses the best topographical and hygienic advantages, as is natural considering the long investigations which have been made, at great cost, by technical commissions. Bello Horizonte is not yet a city, for, in spite of the new palaces of the president and the offices of State, and a considerable number of private houses scattered over a wide space, there is no group of buildings that may be regarded as the nucleus of future expansion.

Over the large urban area of 10,543 yards square, and the suburban of 29,800, calculated to accommodate a population of 300,000, have sprung up here and there at long intervals, where ground could be bought cheap, groups of houses or isolated dwellings, inhabited by some twelve to fifteen thousand people. The expenses of roads, illumination, cleaning, and water-supply over the whole area would entail an expense quite out of proportion to the number of inhabitants, and therefore nothing has been done. The streets remain just as they were marked out in the reddish clayey soil, which is transformed by the rain into an immense quagmire, while, in the dry season, the pedestrian plunges into a layer of dust, rising at the slightest breath of wind in dense yellow clouds. Living is dear, as all goods are imported; a little garden produce is raised by Italians, to whom plots of ground in the neighbourhood were sold for the purpose.

No great results in city-building can be obtained with an expenditure of £960,000, and even this has exhausted the treasury, so that, after four years of work, the development of the city has come to a standstill. To get over the difficulty, a strong tide of immigration is necessary, and increased trade. But this is scarcely possible while there is no road into the interior or to the south of Minas, and the communication with the federal capital is hampered, and the tariff very high. The fall in the price of coffee, owing to overproduction, has greatly affected the prosperity of Minas Geraes, and other crops which have been introduced are not yet remunerative, and perhaps will never be so profitable as coffee, nor do mining industries yield the results that might be expected from the abundance of minerals in certain parts of the State. Many commercial houses at Bello Horizonte will probably be bankrupt by the end of the year, and their establishments closed.

AUSTRALASIA.

German New Guinea.—The *Nachrichten über Kaiser Wilhelms-Land* for 1898 contains a few notes on the tribes living to the west of Dallmannhafen and on the islands off the coast. Fifteen miles south-east of Seleo begins the Cham district, extending for eight miles along the coast and densely clothed with coco-palms. The inhabitants are inert and lazy. Their chief food is sago-bread; this palm grows abundantly in the marshes behind the coast. The plantations, in which yams, taro, and sweet potatoes are grown, are tended solely by the women. When the fields lie at a distance from the villages, the men accompany the women, but lie smoking under a temporary shelter while the women do the work. The young people live in a house apart from the other buildings of the village, and have to do certain work for their elders. This tribe owns no canoes and, as the necessaries of life are easily obtained, are not disposed to enter into commerce. There is no social organisation among them, but in war the villages assist one another. Though Suwain lies only ten miles eastwards there is no communication with this district. Towards Suwain the Torricelli range approaches the coast, and at the easternmost village abuts on the sea.

The natives of Suwain are much more intelligent than those of Cham. There are among them two chiefs, whose influence is considerable over their respective villages, though it does not extend over the whole district. Every village owns a canoe in which the people can visit the neighbouring districts and the islands. Once a year, during the south-east trade-wind, they visit Tamara island in Berlin Hafen to trade for pots. Among this tribe the men take a share of the plantation work. Between Suwain and Dallmannhafen the coast is mountainous and sparsely inhabited. Coco-palms are seen on the ridges far in the interior.

Twelve sea-miles from the coast, in a northerly direction, lie the two islands Bertrand and Gilbert (Tarawai and Valise). The inhabitants are at a higher level of culture than the Suwain people. They are quite a distinct race, though their manners and customs are similar to those on the mainland. Each island possesses an influential chief. A stranger is at once struck by the superior position of the women. The heavy field work is done by the men, the women weeding and gathering in the crops. The extensive plantations are kept in very good order, and the excellent black vegetable soil yields an abundant harvest. Early in the morning all the younger people set off to the fields in canoes or by the numerous footpaths, the older people remaining in the village and occupying themselves in repairs or manufacturing bangles of shell. Before a crop is harvested a great feast is held and the blessing of the tutelary spirit of the village is implored. Only when this spirit has indicated his presence by certain signs may the harvest begin. Both islands have a deep indentation on the south-east, which would serve as good harbours. In the interior of both is a sheet of water surrounded by elevations, which is used by the natives for bathing.

D'Urville or Chagur, the first island to the west of Dallmannhafen, may be reached from Tarawai in a few hours. The natives are reserved, and do not trade.

The small Meta island immediately in front of Dallmannhafen is inhabited by people who once owned plantations on the mainland, which were destroyed by mountaineers, the Mingar tribe; now they subsist on fish. Every village has its spirit or ancestor house, and a man elected for the purpose has the duty of summoning the spirits by means of a water-pipe of bamboo. Before the incantation the women must leave the village, having previously laid a great feast in the spirit house, which is consumed by the men before their return. Of late years the worship of spirits and ancestors has fallen into neglect. No doubt is held as to a

life beyond the grave, and therefore these natives look forward to death with great equanimity. The dead are buried beneath the house, and the women of the village mourn for them fourteen days, never leaving the grave day or night.

Deslacs, one of the "French" islands, has two fine harbours, Balangori, or Johann Albrecht Hafen, on the south, and Meto, or Peterhafen, on the east. It was formerly densely peopled, but smallpox, introduced two years ago from Neu-Pommern, has swept away so many of the natives that many villages have been entirely depopulated. A large area is unoccupied. On the east the Lamu district contains high mountains, and slopes down to the Johann Albrecht harbour, ending in cliffs several hundred feet high. The loamy soil bears luxuriant coco-palm woods, and fine taro and banana plantations surround the villages. In the harbour are two islets, of which the largest, Bomakarre-karre, is closely wooded, and is 550 yards long by 220 broad. The inhabitants of the different districts in the island are often at feud, and have the destructive practice of felling the coco-palms on the death of the owner.

GENERAL.

The Climate of the British Empire in 1897.—The usual annual summary is given in *Symons's Monthly Meteorological Magazine* for February, and is as follows :—

Highest temp. in shade .	110·8° at Adelaide, on Dec. 16th and 28th.
Lowest „ .	−41·0° at Winnipeg, on Feb. 25th.
Greatest range in year .	133·7° at Winnipeg.
Least „ „ .	20·6° at Grenada.
Greatest mean daily range .	23·6° at Winnipeg.
Least „ „ .	9·7° at Grenada.
Highest mean temp. . .	82·2° at Colombo.
Lowest „ „ . .	34·7° at Winnipeg.
Driest station . . .	Adelaide, mean humidity 59.
Dampest „ . . .	Esquimalt „ „ 86.
Highest temp. in sun . .	166·3° at Adelaide.
Lowest temp. on grass . .	−11·0° at Toronto.
Greatest rainfall . . .	83·64 in. at Grenada.
Least „ . . .	14·22 in. at Malta.
Most cloudy station . .	Esquimalt, average amount 6·7.
Least „ „ . .	Grenada, „ „ 2·5.

Most of the extremes have occurred at the same stations in other years, and appear to be thoroughly normal (see summary for 1894, in vol. xii. p. 91). The chief exceptions are the highest mean temperature and the least amount of cloud. The former, 82·2 at Colombo, has not been exceeded since 1876, when the mean temperature at Madras was 83·2°, while the highest previous value for Colombo was 81·9° in 1880. The latter, 2·5 at Grenada, is unprecedented in the twenty-one years, the nearest approach being 2·9 at Malta in 1885. The returns for Trinidad are unfortunately incomplete, but in May a maximum shade temperature in the sun of 173·0° was recorded—a higher reading than is given for Adelaide in the table.

Maritime Commerce.—In a paper read before the American Association for the Advancement of Science, Dr. E. L. Corthell stated that the sea-borne commerce of the world has increased from 26,500,000 tons in 1848 to 201,000,000 in 1898, and the total number of steamships from 242, with a tonnage of 74,700 and an indicated horse-power of 2,000,000, to 11,271, with a tonnage of 17,889,006 and an indicated horse-power of 60,000,000. The average length of the twenty largest steamships has increased from 230 to 541 feet, the average breadth from 36·2 to 61 feet, and

the average depth from 23 to 39 feet. The average speed of the twenty largest steamships has increased from 9·2 to 18 knots, and of the twenty fastest from 10 to 22 knots. Twenty-seven feet is the extreme depth to which a ship can load on either side of the Atlantic, and therefore while the great Atlantic liners are increasing in length and breadth, their draught has to be kept the same, and with this restriction an absolute limit of speed will soon be reached. Liverpool is being improved more than any port in the world, being widened and deepened so as to accommodate vessels up to 900 feet in length, 90 feet at the beam, and of 36 feet draught. Improvements on a smaller scale are being made at London, Hamburg, Antwerp, New York, Boston, Philadelphia, New Orleans, and Galveston, while the depth of the Suez Canal has been increased from 26 to 28½ feet, and will be presently carried down to 30 feet.—*The National Geographic Magazine*, Feb.

MISCELLANEOUS.

By the **Anglo-French agreement**, just drawn up, the boundary of the Egyptian Sudan will follow the watershed of the Bahr-el-Ghazal and include the whole of Darfur. Fuller details, with a sketch-map, will be published in the May number.

It was stated on p. 158 that the island of **Chusan** had been annexed by the British Government. We are now able to state on the best authority that the report, which has been widely circulated, is unfounded. No such step has been taken.

One of the most important treatises in the eighteenth *Annual Report of the U.S. Geological Survey* is **The Triassic Formation of Connecticut**, by William M. Davis, accompanied by maps and numerous illustrations. It has been issued in advance in separate form.

M. E. de Sainville, who has spent several years in the vicinity of the mouth of the **Mackenzie river**, has observed the extreme temperatures of 98° and – 67° F. (winter of 1893-94). As a rule, the thermometer does not sink in winter below – 58°. —*Ciel et Terre*, March 1st.

Captain Wellby started from Addis Abeba in December, with the intention of travelling by Zakwala hill to Lake Zuai and the lake south of it, and then striking the Omo in 7° N. lat., to follow this river to **Lake Rudolf**. After this he will perhaps make for the Sobat.—*Geogr. Journal*, March.

In the chart of soundings taken by the **German Deep Sea expedition**, published last month, the number of fathoms is not given at a station west of Walfish Bay just north of the sounding 2756. On a very hastily drawn tracing of the original chart, the sounding appeared as 5360 fathoms, which was of course rejected. Since the publication of the chart, we have had another opportunity of inspecting the original, and have little doubt that the 0 is intended to represent an elevation in the bed of the ocean, 536 fathoms below the surface.

Mr. Cook, the Director of Meteorology, has published a report on the **rainfall in Mysore** in 1897, accompanied by tables and charts of the average records during the years 1870-97. Over the whole province the average was 42·93 inches, or 6·25 inches above the twenty-eight years' average. This excess was fairly equally distributed over all the districts. The distribution of the rainfall for the four quarters of the year, for the two monsoons and for the whole year are shown in maps. If contours had been given, the causes of the distribution would have been more apparent.

Lieut. Peary intended to send back the *Windward* on his arrival in Sherard Osborn fiord. As the vessel has not arrived, it is proposed to send out another steamer next summer to Whale Sound with provisions. Dr. Robert Stein, who in 1894 planned an expedition to **Ellesmere Land**, will avail himself of this opportunity to reach Cape Sabine. There he intends to pass the winter, and in the following spring will endeavour to follow the coast of Ellesmere Land from Hayes Sound westwards and southwards to Cape Eden on Jones Sound, returning to Cape Sabine to meet the steamer.—*Petermanns Mitt.*, No. 2.

Prof. A. G. Nathorst considers it within the bounds of possibility that Andrée and his companions, if they came to earth in north-east **Greenland**, may not have had time during the short summers to make their way to a settlement, and yet may have been able to sustain life in a country where the fiords penetrate deep into the land and musk oxen are numerous. He therefore proposes to charter the whaler *Hekla*, and try as early as June to break through the ice-barrier if possible in the vicinity of Cape Bismarck, lat. 77° N. Thence he will make his way northwards with boats and sledges. He does not intend to winter in Greenland, but he may be obliged to do so.—*Petermanns Mitt.*, No. 2.

At the Indian Head experimental farm, NW. Territories, 120,000 **trees** are growing in shelter-belts, hedges, and plots, and 100,000 at the Brandon farm, Manitoba. Two hundred species and varieties are planted at Indian Head, and one hundred more at Brandon, and all these have proved to be suited to the localities. There is great interest shown in arboriculture, by which the attractions of a homestead are greatly enhanced, and the demand for proved trees, such as the Manitoba or ash-leaved maple and the green ash, is greater than the supply. During the past seven years more than six tons of seeds of these and other trees have been collected by Indians and half-breeds and distributed at the expense of the Government.—*The Canadian Gazette*, March 16th.

At the International Geographical Congress, held in London in 1895, Professor W. Libbey, in treating of the Gulf Stream and the Labrador current, mentioned the appearance of the **tile fish** (*Lopholatilus chamæleonticeps*) off the coasts of the United States in 1882 and 1892 (see vol. xi. p. 471). A few specimens were caught, as we learn from the *Revue Scientifique*, No. 9, in the following years. In 1898 the *Grampus* was sent out on purpose to look for the fish, and, though not very well equipped for the fishery, was very successful. It appears that the tile fish is abundant off the coast of Long Island within an area 140 miles long by 25 broad, and probably has a more extensive habitat. The fish is excellent eating, and is of large size. The 203 fish caught in October weighed together 2990 lbs., an average of fully $14\frac{3}{4}$ lbs. each.

The National Geographic Society, Washington, offers two prizes of $150 and $75 for essays on **pre-Columbian Discoveries** and settlements of the Norsemen on the mainland of America, and the location of the lands mentioned in the Icelandic Sagas. The essays should be type-written, and not exceed 6000 words; they may be accompanied by maps and illustrations for the explanation of the text but not for embellishment. They should be signed by a pseudonym or number, and bear no other indication of authorship, but each should be accompanied by a sealed envelope marked with the pseudonym, and containing the name and address of the author. The competition will close on Dec. 31st, 1899. Should one or both prizes not be awarded owing to the inferiority of the essays submitted, a new competition will be opened.

NEW BOOKS.

The New Far East. By ARTHUR DIÓSY. London, etc.: Cassell and Co., 1898. Pp. xii + 374.

In *The New Far East* Mr. Diósy has fully sustained his reputation as a sympathetic and well-informed student of all that pertains to the Orient. The book, we are told in the preface, is not intended for the expert; but many a man who has spent years in China or Japan would be safer in taking Mr. Diósy as his guide than in trusting to what he imagines to be his own opinions based on facts, which opinions are, however, not unfrequently the outcome of incomplete knowledge or biassed judgment, or the relics of errors that die hard. A critical examination of those sections which treat of the Japanese in their own land proves how intimate is the author's knowledge, an intimacy gained, be it remembered, not by residence in Japan, but by enlightened conversation with Japanese lords and ladies, naval and army officers, students of the best type, European men of mark whose names are household words to all who have an interest in the Far East, as well as by careful reading and sifting of the views expressed by the great army of writers, from fleeting tourists to profound philosophers who have or think they have a message to give to the world. Readers of all kinds will find much of interest in Mr. Diósy's pages. For example, some of the most thrilling episodes of the late war between China and Japan are told with graphic power. The tragic tale of Admiral Ting's last fight and suicide touches the heart with a deep pity for a really great man victimised by a corrupt, effete Government. Then there are shrewd views upon the commercial future of the Western Pacific, and a clear-cut picture is drawn of the real "Yellow Peril," when China shall waken up, and, absorbing the progressive spirit of the West, prove an industrial rival to the white man. The political student will find much to engage his attention; and, even though he may not go all the way with Mr. Diósy in distrust of Russia, he will be ready to admit the general soundness of the author's contention that Britain must have a definite policy in the Far East which she is prepared to carry out "with the calm force of the strong man armed." All who have really *lived* among the Japanese will welcome the strong protest uttered by Mr. Diósy against the foolish superficial and at times libellous talk certain writers indulge in regarding Japanese women. Books of the type of Pierre Loti's *Madame Chrysanthème* are responsible for a great deal of erroneous generalisation, somewhat after the manner of the worthy Japanese mate who, basing entirely on his experiences in the vicinity of the London docks, commented (in letters written to a Tokyo newspaper) on the want of refinement of the "ladies of the metropolis," who "commonly eat fruit as they walk along the streets, and frequently take their meals of shell-fish, fried fish, stewed eels, or potatoes, at perambulating food-stalls in the open air."

An interesting feature of the book is the series of illustrations which beautify it. Twelve of these were drawn specially for the book by Kubota, a Tokyo artist. Each picture represents a phase of either Old Japan or New Japan, and very interesting and instructive are the contrasts provided. Compare, for example, the Prime Minister addressing the House of Representatives in Tokyo (1898) with the Tokugawa Shogun holding a Council meeting just before the Revolution of 1868; or the picturesque warrior of 1850 with the sergeant in field service order in 1894. The German Emperor's cartoon, "The Yellow Peril," is reproduced. Probably, however, Kubota's representation of the same idea is the more correct though infinitely the more prosaic.

In the Niger Country. By HAROLD BINDLOSS. With two Maps. Edinburgh and London: William Blackwood and Sons, 1898. Pp. 338. *Price* 12*s.* 6*d.*

If the number of books which have been and are being written about the Niger country is any criterion of the interest of the public in that unwholesome region, it would seem as if Nigeria were at present one of the most interesting places on the globe. In the volume we have now before us, "Harold Bindloss" goes over once again the now well-worn ground, and in his hands the familiar story of the Gold Coast is as fascinating and wonderful as ever. The truth regarding this pestilential region of swamp and malaria, where nature apparently has issued a fixed decree that no white man shall live, has been told over and over again, and yet the fascination of the country remains as strong as ever. In the cold language of political economy the supply equals the demand—that is to say, neither danger nor pestilence, neither the sorrow of exile nor the fear of death, can exclude the white man, be he merchant or be he official, from a region where the chances are heavily against his living half a dozen months. Nigeria is a problem to the philanthropist, the statesman, the engineer, the merchant, the doctor, the sailor, the missionary, the ethnologist, and the true key to its solution has not yet been found, although almost every nationality in Europe is represented there, and soldiers, traders, and missionaries have been working zealously at it for many years.

Take the question of the slave-trade. Regarding this Harold Bindloss writes: "Slavery is still prevalent in Western Africa, and is of two distinct kinds. The first is the wholesale raiding and burning of villages, whose inhabitants are carried away and sold beyond the desert as far as Morocco and Fezzan by the Arabs of the Hinterland. This has been written of many times, and goes on to-day to a great extent unchecked. The second, termed 'domestic slavery,' and practised by the Negroes only, is to be met with in many places along the coastwise strip; and as, with the exception of the races already mentioned (*i.e.* Kroomen and some others), it is practically impossible to induce the free Negro to labour with his hands, forced servitude of some kind is almost a matter of necessity. Thus it is that the British Government, in spite of the popular but mistaken idea that no slave can exist beneath the flag, finds it inexpedient to attempt its suppression altogether, and in several districts at least contents itself with doing what may be possible to alleviate the lot of the slave. Slaves are acquired in the Niger bush by the simple process of raiding a weaker village when the troops are somewhere else, or by the purchase of servants so obtained, or by parents selling their children, a custom common enough."

Perhaps the author of this book is seen at his best in his descriptions of bush warfare, the conditions of which are so different from those of any other part of the world that it is very difficult to realise them. He does not, however, forget the interests of trade. Remarking on the unaccountable appearance in Nigeria of engraved gun-barrels and richly chased hilts of Arab swords, which seem to have come from Damascus or still farther East, he points out that "France is thoroughly alive to the importance of this trade, for while we British have to a great extent been calmly content with the unhealthy coast, she has been tirelessly exploring the Hinterland. A repetition of this statement may be pardoned, for the fact is of supreme importance to the welfare of our colonies, and may be forced upon the attention of those at home sooner or later. The following difference between the policy of the two nations should always be clearly remembered. When we British open up a country we are content to hold the trade, if we can, by means of low prices and the quality of our merchandise, while any nation finds a free market there. Indeed there are several prosperous German factories in our Niger Pro-

tectorate. It is not so with France. Once she establishes a protectorate, the traders of every other country are at once driven out by duties, which is one reason why associations of British merchants have periodically urged the development of the Hinterland, and the laying down of light railways, upon the attention of Her Majesty's Ministers."

To all interested in Nigeria this well-written book will be very welcome; it is equipped with good maps.

Through New Guinea and the Cannibal Countries. By H. Cayley-Webster. London: T. Fisher Unwin, 1898. Pp. xvii+387. *Price* 21*s.*

In his journeys in 1893 and 1895 to New Guinea and the cannibal countries the object of Capt. Webster was not so much geographical research as to investigate the lepidoptera, coleoptera, and ornithology of these inhospitable regions. His collection at the end of his second journey included over eighty-three thousand specimens, among which were many new to science. Large as it is, he himself explains that it is very far from complete. The reason for this was the dangers arising from the character and habits of the people. Notorious cannibals, they are treacherous in the extreme, and Capt. Webster soon found that, when they seemed most friendly and kind, it was time to get on board his yacht and be off elsewhere. One geographical point we feel bound to notice.

Capt. Webster sailed to Astrolabe Bay on the north of the island of New Guinea, and landing there he penetrated inland for forty-two miles. There he ascended a peak 4500 feet above sea-level, and he says: "Having ascertained the true position of the Albert Victor range of mountains in British New Guinea, which was from here plainly discernible, and also the various landmarks on the coast of German New Guinea, it was useless to prolong our stay. I unhesitatingly assert that the range of mountains marked on the chart as in latitude 6° 10′, longitude 145° 30′ E. (the Bismarck range) is not to be seen in that situation, and, as we cannot change the configuration of the earth, perhaps it may be as well to alter the map, which I believe is now being done. I presume the mistake was caused by some who, ascending the coastal range in German New Guinea, situate some few miles from the coast, observing some high range in the interior, returned with the news that such a range existed, and proudly named it after the late ex-chancellor, when in all probability they were gazing at the Albert Victor range in British New Guinea."

How it happened that Capt. Cayley-Webster failed to distinguish these mountains is hard to explain. The main mass certainly lies more to the north-west than the position he quotes, but scarcely farther from where he stood than the Albert Victor range. It is much to be regretted that the author has not made himself acquainted with the results of later German exploration; the Lauterbach expedition of 1896 placed the existence of the Bismarck range beyond all doubt, for it actually set foot on the mountains. Though in this case Capt. Cayley-Webster has made too hasty a conclusion, he is a careful observer and intrepid traveller, as was felt by those who heard his lecture to the Society in 1895.

We must add that the numerous illustrations in this handsome volume are unusually good.

El Dorado: Reise und Kulturbilder aus dem Südamerikanischen Columbien. Von Prof. Ernst Röthlisberger. Bern: Schmid und Francke, 1898. Pp. 366. *Price* 7 *marks.*

In 1881 the Swiss Government was asked by the Colombian to recommend a young Swiss scholar for the Chair of Philosophy and History in the University of

Bogota, the capital of Colombia. The author was nominated, and in this volume he describes his experiences and observations during his stay in the country he designates "El Dorado," as that fabled land of gold was first sought for on the uplands of Bogota. Although the author found Colombia to be no El Dorado, yet he heartily appreciated its beautiful scenery, its remarkable development, its variety, and its inhabitants. Bogota, the capital (population 1894, 120,000), is situated 9000 feet above the sea-level, with a mean temperature of 59° F., the greatest heat being 71° F., whilst the lowest temperature was 42° F. The upper classes in Bogota are Whites, and live in luxury, yet cultivate their minds, for the author's lectures were attended both by ladies and gentlemen. The University (founded in 1867) possesses four Faculties—Literature and Philosophy, Jurisprudence, Natural Sciences, and Medicine. As the priests are trained in seminaries, there is no theological faculty. There were, in 1884, 615 students at the university, which can boast of a library of 60,000 volumes. Colombia abounds in poets, and possesses a large number of ballads which have never been printed. The valuable work before us describes the history and people of this interesting country, as well as detailing numerous excursions; it is clearly printed in Roman characters; and it is embellished with numerous and often elegant illustrations. A rather poor map of Colombia is appended.

Au Chili. Par C. de Cordemoy. Paris: Librairie Hachette et Cie., 1899. Pp. 267. *Price* 10 *Frcs.*; *Bound*, 15 *Frcs.*

This work does not pretend to be one of original geographical research, but it contains a very readable, although superficial, description of the republic of Chili, and the excellent illustrations alone would suffice to secure for it a cordial reception. The author writes with all the fluency and ease of style which we generally find in French books of travel. He is never very profound, and although an acute observer, he is sometimes careless of his readers. For example, we have repeated on pages 113-4 a description of the failure in practice of the system of cumulative voting, in exactly the same words which we find in page 82. It is very obvious that Monsieur de Cordemoy has an intense dislike, not to say hatred, of the English, so much so that he can contemplate with complacency the gradual but effective displacement, if not effacement, of English commerce by the Germans; and he seems to look forward with pleasure to a time when the German flag will take the place of the Union Jack in the carrying trade of the world. On this point we may quote what he says: "Valparaiso est tout à fait anglais: si l'on veut la comparer à quelque autre cité, il faut penser à une ville d'Angleterre. Adieu les espérances de couleur locale! Aux vitrines des libraires brillent les Baedeker, le Graphic et les couvertures aux tons criards des romans anglais. Dans les rues on rencontre des misses dont les blonds cheveux ne laissent aucun doute sur leur origine. . . . Le principal club, celui de l'Union, fondé en 1843 par un acte en anglais, est encore composé surtout des sujets de Sa Très Gracieuse Majesté. Il n'y a qu'un point noir dans cette omnipotence britannique, c'est l'Allemand. Les maisons allemandes remplacent peu à peu les anglaises. C'est un phenomène qui se reproduit partout à l'étranger. Si l'invasion continue avec l'intensité de ces dernières années, Valparaiso sera bientôt un autre, un grand Valdivia, la colonie allemande du sud du Chili. Pour qui a beaucoup voyagé, le véritable vaincu de 1870, sur le terrain commercial, c'est l'Angleterre. La prépondérance politique de l'Allemagne lui a permis le développement de sa puissance mercantile sur tous les marchés du globe, et pour prendre le premier rang elle a évincé les Anglais. Encore vingt-cinq ans de ce régime et la prépondérance commercial de la Grande-Bretagne aura vécu."

If this book ever reaches a second edition, it would be greatly improved by the addition of a good map and index.

Earth Sculpture. By Professor J. Geikie, F.R.S. ("Progressive Science Series.") London: John Murray, 1898. *Price 6s.*

The author explains in the preface that this volume is intended for readers not specially skilled in geology, who may be in want of an introductory treatise on the origin of the surface features of the earth. The study of "terrestrial physiognomy," as the subject may perhaps be otherwise described, is one full of attraction to travellers who view nature with an intelligent eye, and have an appreciation for scenery and the causes that contribute to its charm and variety. That the present external features of the land we live on are the work of the long-continued processes of erosion, denudation, and upheaval, must, after the perusal of this volume, be more or less apparent even to the non-geologist. By way of proof the author supplies a large selection of sections showing the types of scenery produced by the wearing away of rocks of different kinds and varying structures. As the book is meant for general readers, one cannot but regret that the author has not seen fit to supply more purely topographical sketches, such as the admirable illustrations, Figs. 25 and 26, from Powell's great work on the Colorado cañons, which show at a glance not only the structure beneath, but also the scenery peculiar to that particular type of structure. The section Fig. 56, although beautifully drawn, seems rather complicated for an elementary work such as this, and even if true to nature is not likely to be intelligently understood by a beginner, who would probably prefer a few more photographs such as those of the Cairngorm granite, or the very characteristic view at p. 163, showing the erosion of a plateau of horizontal strata, with old volcanoes in the distance. Professor Geikie has naturally much to relate about the work of glaciers and ice-sheets, the origin of lake basins and the forms of coast-lines, all of which is full of geographical interest.

The scheme of the book is exhaustive and well arranged, each department of a very interesting subject receiving adequate treatment. It is a volume that cannot fail to be of use in assisting the general reader to take a more intelligent interest in the picturesque features of the earth surface wherever he may happen to be travelling.

Alboran. Prague: H. Mercy und Sohn, 1898. Pp. 89.

This little island is situated between Morocco and Spain, and lies about 130 miles to the east of Gibraltar. It contains a lighthouse of the third class, erected in 1876 by the Spanish Government, to whom the island belongs. The area of the island is about 215 acres, and its population consists of eleven persons. The author gives ample scientific details, and excellent illustrations from his own sketches: also maps of Alboran, an island which may yet perhaps attract the attention of some Great Power. Like all this author's works, his monograph on Alboran is written, printed, and illustrated in a faultless manner, and on a splendid scale.

A History of Egypt under Roman Rule. By J. Grafton Milne, M.A. London: Methuen and Co., 1898. Pp. 262. *Price 6s.*

Apart from its archæological interest, the practical value of a book like this is that it shows the present British rulers of Egypt how their great forerunners, the Romans, successfully governed it For one thing, they "interfered as little as

possible with existing institutions." Again, autocratic rule was preferred to any other, because it enabled the Roman Prefect in Egypt to act promptly, he taking his orders from the Emperor direct, without interference by the Roman Senate. No member of the Senate could even set foot in Egypt without the special leave of the Emperor.

The Roman prefect was the Emperor's representative. "His power was limited only by the right of appeal to the Emperor; and he was the head of every branch of the administration—financial, judicial, and military." The Romans held Egypt with a small body of troops (only one legion under Trajan), and these were mainly recruited from Egypt. "The military forces were placed under a *dux*, whose authority extended over the whole country till about 380 A.D., when the province was split up into three military divisions—the limes Aegypti, including Lower and Middle Egypt, under a *comes*; the Thebaid under a *dux*; and the two divisions of Libya, likewise under a *dux*."

Although there are masses of papyri relating to Roman Egypt waiting for publication in half a dozen different museums, a carefully compiled, well-illustrated, handbook like this was wanted, and will be much appreciated. It forms the fifth volume of the series, of which the first three were written by Mr. Flinders Petrie.

The Founding of South Australia as recorded in the Journals of Mr. Robert Gouger, first Colonial Secretary. Edited by EDWIN HODDER. London: Sampson Low, Marston, and Co., 1898. Pp. 239.

Robert Gouger was born in 1802, and was educated at Nottingham, removing thence to London, where his father was a merchant. In 1830 he took an active part in the Spanish Revolutionary War. In 1831 full particulars reached England of Captain Sturt's discoveries in South Australia, and Robert Gouger, Secretary of the National Colonisation Society, and others approached Lord Goderich, Colonial Secretary, and submitted a scheme for founding a colony in South Australia. Lord Goderich threw cold water on the project, but Mr. Gouger stuck to it, and in 1833 formed a "South Australian Association" (of which he was Hon. Secretary), the object of which was "to found a colony under Royal Charter, and without convict labour, at or near Spencer's Gulf, on the south coast of Australia, a tract of country far removed from the existing penal settlements." Next year (1834) an Act of Parliament was passed "to erect South Australia into a British province," and under it Mr. Gouger was appointed the first Secretary to the colony, and went out in 1836, after the South Australian Company had been formed with a subscribed capital of £200,000. What is called here "a reign of squabble" ensued, during which Governor Hindmarsh quarrelled with all other officials, and suspended Mr. Gouger. Hindmarsh was peremptorily recalled, and Mr. Gouger returned to England to find he had been reinstated. Returning to the newly founded capital of the colony (Adelaide) in 1839, he became, under Governor Sir George Grey, Colonial Treasurer, which post he held till 1844, when he retired owing to bad health, and again returned to England, where he died in 1846. As a record of a life devoted to the establishment of what is now an important colony, this book was well worthy of publication.

The History of Mankind. By Professor FRIEDRICH RATZEL. Translated from the second German edition by A. J. BUTLER, M.A. Vols. ii. and iii. London: Macmillan and Co., 1897-98.

In our issue for December 1896 we reviewed the translation of the first volume of the second edition of Professor Friedrich Ratzel's important work. Since then

we have received the remaining twenty parts which complete the translation, so that now the whole work is available for English readers, although of course in a considerably condensed form. It is a monument of industrious erudition and patient accurate compilation. Dr. Ratzel is not prone to indulging in theories or speculations, although his subject provided unusual temptations in that direction, and he rarely enters the lists to combat theories or assertions which have already been put into print. He has found it quite enough to stick to facts, and these he lays before his readers in a cold, unimpassioned fashion, which it has to be confessed is often not very winning or attractive. On the other hand, the reader must acknowledge the scholarly thoroughness with which he has done his work and the sterling value of the book as a treasure-house of well-sifted information from which the historian, the philanthropist, the student of humanity, the antiquarian, the ethnographer and others can draw in abundance, and in this they will be materially assisted by the good index which completes the work. The illustrations in the later volumes are as numerous and as successful as in the former.

Nova Scotia: its Agricultural Resources. By B. W. Chipman, Secretary for Agriculture, Nova Scotia. Halifax, N.S.: Commissioner of Public Works and Mines, 1898.

In this little pamphlet Mr. Chipman, the Secretary for Agriculture, has done for the agriculture of Nova Scotia what Dr. Gilpin has done for the mines. He takes his readers a tour through the island, pointing out in some detail the capabilities of every tract of the country and its attractions for the farmer. Sufficient but not unnecessarily minute information is given, and the prices of farms are stated for the information of inquiring emigrants. The other attractions of the island, especially its excellent system of education, are not forgotten.

Profilo Antropologico dell' Italia: Memoria premiata dalla Società italiana di Antropologia ed Etnologia in Firenze. By Francesco L. Pullé. With 3 small Maps, and a separate explanatory Atlas of 7 Maps. Firenze: Salvadore Landi, 1898. Pp. 139.

In this able treatise, which appeared in last year's *Archivio per l'Antropologia e l'Etnologia*, the author takes a comprehensive survey of the peoples of Italy from pre-Roman times to the present day. The first section is devoted to a consideration of the early races, chiefly from the point of view of language and of craniology; and it is interesting to note that the aboriginal race is described as swarthy, small-statured, prognathous, having low foreheads and snub noses, and probably of African origin—all of which accords with what has already been indicated by Professor Giuseppe Sergi. The mediæval and modern populations are next dealt with; and two sections specially discuss their physical and psychological characteristics in minute detail, with relative statistics and data. The whole work is very instructive and interesting, and the text is admirably illustrated by the interleaved map and the accompanying atlas.

Routes in Jammu and Kashmir. Compiled by Major-General Le Marquis de Bourbel, R.E. (retired). Calcutta: Thacker, Spink, and Co., 1897. Pp. xvii + 396.

This is a book for reference, not for perusal. It has been prepared in great detail—like a route-book for the Quarter-Master-General's Department—and evidently with much care. The compiler states that his object has been to present in a tabular and condensed form such information as may give the traveller some idea

of what lies before him, afford him some help in his movements, and enable him to make timely arrangements to prevent detention on the march. The book is well calculated to accomplish this. It likewise can hardly fail to be useful to those who have to do with the administration of Kashmír and its dependencies, and to others who are interested in the passage of trade in and across those regions.

Five centres have been selected within the territories of the Maharájá of Kashmír—namely, Jammu and Púnch on the Indian side of the Pír Panjál ranges, Srínagar in the vale of Kashmír itself, and Gilgit and Leh in the regions north of the Indus. Routes (152 in number, including diversions) starting from these centres, and traversing the Kashmír State to places both within the State and beyond it in neighbouring territories, are described in systematic order. The halting places on each route are given; the distances between them; their height above sea-level; their probable resources in the way of accommodation, supplies, transport and objects of special interest; and the nature of the country and of the road or track between them. The general accuracy of the information is guaranteed by the fact that the compiler is an experienced officer of the Royal Engineers who for a considerable period held the appointment of Chief Engineer to the Kashmír State. A list of the routes described prefaces the detailed tables, and an index of places has been added. The index, however, is not quite perfect; we have detected the absence from it of several places given in the routes, no reason for the deliberate omission of which is apparent.

The Statistical Year-Book of Canada for 1897. Ottawa: Government Printing Bureau, 1898. Pp. 554.

Mr. Johnson's compilation of statistics and record of events is on the same plan as the previous volumes, many of which have been noticed in these pages. It is the standard book of reference on the industry and commerce of the Dominion.

Stark's Jamaica Guide. Fully illustrated with Maps, Engravings, and Photoprints, by James H. Stark. London: Sampson Low, Marston and Co., Ltd., 1898. Pp. 207.

The attractions of Jamaica as a winter resort are becoming increasingly popular among sun-seekers, both European and American. The change from our cold, grey, wintry skies to the brilliant sunshine, the wonderfully blue seas, and tropical vegetation of "The Gem of the Antilles" will always attract a large proportion of winter tourists. To intending visitors Mr. Stark's Guide presents, through its graphic descriptions and illustrations, a very complete picture of the island and its life. To actual tourists it will be invaluable as giving practical information on almost every point of interest. The numerous reproductions of photographs are very good, but the maps might have been much better.

Autour de la Méditerranée. Les Côtes Orientales. L'Autriche et la Grèce (De Venise à Salonique). Par Marius Bernard. Paris: H. Laurens, 1898. Pp. 388. *Price* 10 *frcs.*

In a pleasant, gossipy way, yet showing that he knows his subject well, M. Bernard conducts us on a tour which is at once a novel and delightful one. Starting from Venice, he proceeds to Trieste, and then skirts the whole Eastern shore of the Adriatic to Greece, describing as he goes Friuli and Istria, Fiume and Croatia, Dalmatia, Herzegovina and Bosnia, Montenegro and Albania, Acarnania and Phocis, Achaia and Messenia, Laconia and Argolis, Athens, Attica, and the Island of Crete, the Cyclades and Eubœa, Bœotia and Thessaly. There are 131 illustrations and a map.

NEW MAPS.

ASIA.

INDIA, Atlas of ——. Whole Sheets, 46, 76, 88, 106. Quarter Sheets, 1 NE., 3 NE., 9 SW., 10 SE., 11 NE. and SW., 24 NE., 26 SE., 27A NE., 31 NE., NW., and SE., 32 SW., 33 NW., SE., and SW., 35 NE., 36 NE., 37 NE., 39 SE., 48 SW., 49 NE., 52 NW. and SE., 61 SE., 66 SE., 67 SE., 69 NW., 71 NE. and SE., 72 NE., NW., and SE., 77 SE., 87 NW. and SW., 89 SE., 91 SE., 124 SW., 127 SE., 129 NE.

—— Scale 1 inch = 126 miles.

—— Canal Map, 1897. 6 Sheets. Scale 1 inch = 32 miles.

–, showing railways, with stations, corrected to December 1896. Scale 1 inch = 64 miles.

CENTRAL PROVINCES. With additions to Railways, March 1896. Scale 1 inch = 32 miles. With Index to Places.

PUNJAB, Skeleton Map of the —— and surrounding countries, with additions to Railways up to July 1897. Scale 1 inch = 32 miles.

MYSORE AND COORG, Sept. 1897. Scale 1 inch = 16 miles. With Index to Places.

BENGAL, BIHAR, ORISSA, and CHOTA NAGPUR, 1898. Scale 1 inch = 16 miles.

ASSAM, The Province of ——, 1897. Scale 1 inch = 16 miles.

GUJARAT, March 1898. Scale 1 inch = 16 miles.

NORTH-EASTERN FRONTIER. Parts of Great Tibet, Sikkim, Assam and Bhutan. Scale 1 inch = 64 miles.

TIBET, Map of portion of ——, explored by Captain H. H. P. Deasy, 16th Lancers, in 1898. Scale 1 inch = 16 miles.

Presented by the Indian Survey Department.

SOUTHERN CHINA, Sketch-Map of ——, 1898. Scale 1 inch = 36 miles.

The Intelligence Branch, India.

ATLAS.

TASCHEN-ATLAS DER SCHWEIZ. Gezeichnet und gestocken von Emil Wagner.

Ch. Eggimann und Co., Genf.

This atlas contains twenty-six coloured maps in a small form. They include a general map of Switzerland, a railway map, and a map of each canton. The work has been carefully executed, and the atlas is very suitable for tourists. The colouring is not very agreeable to the eye.

CHART.

CAPE WRATH TO THE FLANNAN ISLES, including the northern parts of the North Minch and Lewis, Nov. 26th, 1898. No. 2386.

Presented by the Hydrographer.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

KAMCHATKA.

By G. E. H. Barrett-Hamilton, F.R.G.S.*

(*With a Map.*)

There is probably no part of the entire northern hemisphere the very name of which conveys so little to the average Englishman as that of Kamchatka, unless it be a vague sense of distance, of desolation, of downright inaccessibility. And it cannot be denied that in many ways the peninsula richly deserves such a reputation, situated as it is at the extreme eastern termination of that almost endless succession of steppe, and forest, and northern tundra which we are accustomed to allude to under the general name of Siberia. Kamchatka is in fact to us a kind of Ultima Thule; it lies almost on the side of the earth opposite to Britain, and with respect to England it has its situation, as an Irishman might say, "at the back of godspeed."

For this very reason it is in many ways interesting to compare the two countries, and were Kamchatka not a peninsula but an island, the parallelism—at least as far as regards their form and position—would be a rather close one. Situated at the exactly opposite extremities of Eurasia, each trends nearly north and south, lies between the 50th and 60th parallels of latitude, and is separated laterally (although on opposite sides) from the mainland by an extensive land-locked sea. Here, however, the parallelism ends, for whereas Kamchatka is free to the south, and has its only connection with the mainland on the north, it is in that very extremity that Great Britain is free, and on the south is saved from being a peninsula by the waters of the slender English Channel.

* Mr. Barrett-Hamilton was an Agent of Her Britannic Majesty's Government for the investigation of certain questions connected with the natural history of the Fur Seals of Bering's Sea.—Ed.

Moreover, whereas England is a country in which the hand of time has well-nigh obliterated the rugged volcanic features of the past, giving it the smooth rounded landscape, the much indented coast, the harbours and rivers to which we in so great a measure owe our commercial supremacy, in Kamchatka we have a region still in all the violent activity of a vigorous volcanic youth, exhibiting a scene of titanic grandeur, probably at the present time not excelled the wide world over—an area wherein a group of active * volcanoes (the highest close on 17,000 feet) still roar and rumble and flash forth flames and ashes and lava, rearing their still unblunted summits skywards in sublime defiance of denudation. Kamchatka, in fact, shows us a picture of what geologists tell us England may have been in times past, before she knew the burdens and blessings of civilisation.

It is no wonder that a land thus situated has been but seldom traversed by scientific travellers or naturalists, whose route thither admits of but two alternatives. They must either proceed overland, a six-months' journey (now greatly shortened by the advancing Siberian railway) by rail and tarantass and river steamer and dog- or reindeer-sledge—or, should they prefer to go by sea, must undertake a voyage half round the world to Vladivostok or Hakodate, and thence a passage in a small coaling or trading steamer to Petropavlovsk. By the overland journey Petropavlovsk, the present capital, can only be reached in winter, when the snow is frozen hard enough to allow the passage of sledges; by sea this town is unapproachable except in summer, for its spacious harbour is closed to the outer world during the wintry season of the year, at which time fog and snow and tempest would seem to meet no rivals in their mastery of the waters of Bering's Sea.

Its very inaccessibility to travellers must be my excuse for venturing to write anything about Kamchatka, for I cannot claim a right to set myself up as an authority on the country, having merely touched its coast-line, and that only on three brief occasions, on my passage to or from the neighbouring Commander Islands. What I have to say, however, even though it add little or nothing to our scientific knowledge, will, perhaps, be of interest to many who are not familiar with the works dealing with the subject in the Russian, French, or German tongues.

It is almost a necessity for any ship which ventures into the western side of Bering's Sea, whether bent on an errand of pleasure, of profit, or of exploration, to touch at Petropavlovsk, for supplies either of coal or of provisions. Petropavlovsk is, in fact, to Kamchatka what Unalaska is to Northern Alaska—the only refuge where a ship's crew may hope to obtain some few of the necessaries of life, of which they may have run short. Thus it is that almost every expedition of any importance to the north-western Pacific has spent at least a day or two in the shelter of the quiet Kamchatkan capital, and so the list of travellers who have visited the country is swelled to a much greater length than would have been the case had we only to deal with expeditions which had for their object the exploration of the peninsula.

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* No less than twelve still active in 1855, and twenty-six extinct volcanoes, besides many hot springs, are enumerated by Karl von Ditmar.

Yet, although the number of travellers, other than Russians, who have traversed the country can be counted on the fingers, their deeds have been of the boldest, and the records which they have handed down have been of the utmost value to geography. First among these, and here as so often elsewhere the pioneer, was Cook's third expedition, and it is now over a century since, in April 1779, Captain Clerke, the successor in command to the great navigator, anchored in Avacha Bay. The careful narrative by Captain James King,[3] * with the excellent accompanying plates by Mr. Webber, the draughtsman of the expedition, has ever since been our main English authority on the original condition of the country, its inhabitants and their dwellings. At all events, on consulting one of the most recent German text-books [30] (vol. ii. p. 224) on the subject, I found there reproduced Webber's plates of the Kamchadales and their curious habitations.

Remaining until June 16th, on which date they sailed for Bering's Straits, the members of the expedition were everywhere received with the greatest kindness and hospitality, both in Avacha Bay and on their way to and from Bolsheretsk, whither Captains Gore and King journeyed in order to pay their respects to Major Behm, the Russian commander of Kamchatka. On their way out of the harbour on June 16th they experienced a volcanic eruption, manifested chiefly by copious showers of cinders and clouds of ash or smoke. After an unsuccessful attempt to force a passage to the north-east or north-west through Bering's Straits, the expedition returned to Petropavlovsk in August, and only left that town finally on October 9th.

Cook's expedition was followed after a few years by that of another great circumnavigator, the Frenchman J. F. G. de la Pérouse,[5] who with his ships the *Boussole* and *Astrolabe* spent the greater part of September 1787 (6th to 30th) in Avacha Bay. La Pérouse's expedition was, however, unfortunate in following so shortly upon "Les Anglais," whose account of the country in general, and especially of Avacha Bay, he found to be "fort exact." Nevertheless we owe to him an interesting illustration of the commercial activity of the Englishmen of the period, as exhibited by the arrival at Kamchatka, in 1786, of a little merchant vessel under Captain William Peters, who had been despatched from Macao† with a special view to attempt to open up a trade with Kamchatka. This venture, however, does not appear to have been received with any great favour by the Russians, who dared not act without orders from St. Petersburg, and Captain Peters only succeeded in disposing of 6000 roubles' worth of goods to the merchant Shelikof, to be shortly afterwards sold by the latter at a profit of 4000 roubles. The Englishman ended his career by a disastrous shipwreck on Copper or on Bering's Island soon after he left Avacha Bay on his return voyage. Only two of his crew were saved, and with them La Pérouse conversed and supplied them with much-needed garments.

* This and the following numbers refer to the Bibliography at the end of the article.

† According to De Lesseps, who states that the owner of the vessel was M. Lanz, a merchant of Macao. Sauer gives her home-port as Bengal, perhaps confusing her with the *Alcyon* whose voyage is mentioned in the next paragraph.

The arrival of this heroic little ship is also mentioned by Coxe[3] from the narrative of Captain Billings, an Englishman employed by the Russians to explore the seas in the neighbourhood of Kamchatka. Some idea of the daring of the undertaking may be gathered from the statement of La Pérouse (p. 101) that "ainsi les vaisseaux du capitaine Cook et les nôtres sont les seuls jusqu'à présent, qui ayent abordé heureusement dans cette partie de l'Asie."

A second trading ship the *Alcyon*, under Captain C. W. Barkley, from Bengal, was found at Petropavlovsk by Billings' expedition in 1792, but such again was the fear of the Russians at acting without authority, that although (according to Sauer[6]) her cargo was both cheap and valuable, and in fact consisted of the very goods of which they were most in need, yet they dared not buy of Captain Barkley, who had to take his merchandise away with him in great part unsold.

As regards Kamchatka, however, our main indebtedness to La Pérouse must be for having permitted his interpreter De Lesseps[4] to remain behind in the country. Left on shore at Petropavlovsk on September 29th, the day before his countrymen sailed in continuance of their voyage, he set out on October 7th overland for France, bearing the despatches of his late commander. On this perilous journey he was fortunate in having for a time the company of Colonel Kasloff-Ougrenin, the governor-general of Okhotsk and Kamchatka. Spending the greater part of the winter at Bolsheretsk in order to avoid the hurricanes of November to January, it was not until the 27th of the latter month that the party started northwards, which they did with a cavalcade of no less than thirty-five sledges drawn by three hundred dogs. Thus equipped they travelled right through the peninsula, the route being first by way of the Bystraia and Kamchatka rivers, and thence by the Yelovka to the eastern coast, along which they passed until they reached the *ostrog* (village) of Karaga, "the last in the district of Kamchatka." Leaving here on 2nd March 1788, they travelled, still along the coast, through the country of the Koriaks as far as the miserable hamlet of Govenski, whence they turned westwards and crossed the peninsula to Pustaretsk on the western coast. During the latter part of this journey (after leaving Karaginsk) they suffered extraordinary hardships from tempests, from starvation and the hostility of the inhabitants, until at Pustaretsk, on March 9th, out of the three hundred dogs only twenty-seven serviceable animals remained, and these could not be restrained from eating their harness. The party were now in the utmost distress, and it was only by the lucky arrival of some whale-meat that De Lesseps, leaving the governor-general behind him, was enabled to push on as a forlorn hope with the few remaining dogs to Kamensk. Here he left Kamchatka for good and all, and the story of his subsequent successful crossing of Siberia does not concern us. His journal bears on every page the mark of a man possessed both of great powers of observation and of no less diligence in noting down what he observed, and his remarks are especially useful both as being those of the first observant foreigner who passed right through the country, as well as for comparison with those of later travellers.

Early as were these voyagers, the country, discovered in 1696 by

sixteen Cossacks under the command of Lucas Semenof Moroski, had long before that date been settled by the Russians, who had, among other evidences of civilisation, introduced log-houses and cotton clothes, the latter for the summer use of the inhabitants. The journeys of these early Russian explorers in Eastern Siberia were directed in every direction and to every country both by sea and land—whithersoever, in fact, they thought might be found new people to subject to tribute, or new sources of wealth in the shape of fur-bearing animals. But, being soldiers or merchants rather than scientists or geographers, they left few charts or histories behind them, and in spite of the hardships endured by men like Bering, Chirikof, Spanberg, Walton, Schelting, Synd, Krenitzen, Lovashef, and Chmitevskoi, the commander of Kamchatka of a hundred years ago looked with pleasurable wonder on the maps constructed by the scientific members of Cook's expedition, and the like of which all the labour of the rude though gallant Russians had been unable to produce. Among the first results of the Russian activity were elaborate descriptions of the country by Krasheninnikof[1] and Steller,[2] the former specially detailed by his Government to be the historian of Kamchatka, the latter for ever famous as the surgeon and biographer of Bering's last expedition, the naturalist to whom we owe the first description of the fur-seal, the sea-lion, and the sea-otter of Bering's Sea. To these two writers all those who have followed them have been, and must ever be, indebted.

Another early Russian writer on Kamchatka was G. H. von Langsdorff,[10] who took part in and wrote an account of the first Russian expedition for the circumnavigation of the world. This expedition, under the command of Captain von Krusenstern,[9] reached Petropavlovsk during the course of its wanderings, on June 4th, 1805, and there split up into two portions, of which the larger shortly afterwards set out for a tour of examination of the coast of Sakhalin, and returned on August 27th of the same year. Before their final departure from Petropavlovsk on October 9th, the officers of the *Nadezhda*, Von Krusenstern's ship, erected a wooden monument, enclosed by a ditch and paling, to the joint memory of Captain Clerke and of the astronomer, De Lisle de la Croyère, the latter a member of Bering's last expedition. On this monument was placed a copper plate, bearing the original inscription to Captain Clerke as copied by La Pérouse from the original wooden monument already far advanced in decay at the date of his arrival.

The second portion of Von Krusenstern's expedition left Petropavlovsk on June 13th, having for its object the exploration of the Aleutian Islands and of the American coast. It was to this expedition that Langsdorff was attached, and after spending the winter of 1805-6 very miserably at Sitka, he returned to Petropavlovsk on September 13th of the latter year. The following winter he spent in Kamchatka, and he seems to have taken considerable trouble to visit the principal parts of the country, including the regions occupied by the Koriaks north of the Tighil. His account of the peninsula, its natural history and botany, its people, their customs and habitations, and, in particular, of their sledge-dogs, shows evidence of very careful preparation. Langsdorff's stay in

Kamchatka terminated on May 13th, 1807, on which day he sailed for Okhotsk.

Yet another explorer of the Kamchatkan coast was the Russian naval captain, W. Golovnin,[12] who was despatched from Cronstadt on a particular expedition in 1807, the most important object being the exploration of the coast of Eastern Siberia. In 1809, the *Diana*, Captain Golovnin's ship, arrived at Kamchatka, and sailed in 1810 to the western coast of North America.

Next in order of time, of those travellers who have left us a narrative of their journeys, is Peter Dobell,[14] who arrived at Petropavlovsk on August 21st, 1812. Thence he journeyed to Nizhne Kamchatsk, the then capital of the country, by way of the rivers Bystraia and Kamchatka, with a view to obtain leave to travel in Siberia from General Petrovski, the Governor. That business accomplished satisfactorily, he returned to Petropavlovsk to make his final preparations, and at length set out on January 15th, 1813, again taking the route to Nizhne Kamchatsk. From that town he took the track already followed by De Lesseps, proceeding northwards along the coast by the ostrogs on the Ozernaia, Uka, Khaliula, Evasha, Dranka, Karaga, and Tumlat rivers, until he reached the steppes of the wandering Koriaks, with whose help he passed across the north of the peninsula and out of Kamchatka at Kamensk. Dobell's journey, taken as it was some eighty years ago, and to a great extent through a region previously untouched by explorers, was both adventuresome and important, and the only fault to be found with one whom a later residence of five years in the country must have eminently fitted to describe it, is his modest abbreviation of his narrative.

In July 1816, the port of Petropavlovsk was visited by Otto von Kotzebue[11] in his ship the *Rurik*. For the voyages of the Russians—heroic as they were—I have here, however, only space for a passing mention. They have been already very fully dealt with, as by the Englishman, William Coxe,[8] who gained his information largely from the works of Krasheninnikof,[1] Steller,[2] and Sauer,[6] and their work has been summarised by Von Krusenstern,[9] and more recently by Müller[16] and Pallas, and by Guillemard,[27] in a chapter on the history and conquest of Kamchatka.

Besides the list given above, I may, however, mention among the later explorers, the names of Laxmann, Billings, Sauer, and Sarychef, of whom Billings, formerly astronomer's assistant to Cook's expedition, deserves our more special attention, because (like Lieutenant Synd of the Royal Navy) he was, though an Englishman, especially intrusted with the command of an expedition for the exploration of the seas in the neighbourhood of Kamchatka. For this reason, namely, the fact that his expedition was a naval and not a terrestrial one, it concerns us here but little, and those who wish to learn more of it are referred to the accounts of it published in English by Martin Sauer, Captain Billings' secretary, and in Russian by Captain Sarychef,[7] who served as an officer of the expedition, neither of whom, however, seem to have been satisfied with his commander. Sauer's work contains in addition a short, but excellent, general account of Kamchatka.

Unexcelled for daring was the overland journey of Captain John Dundas Cochrane,[13] of the Royal Navy, who in February 1820 set out from London with the intention of reaching Bering's Straits on foot. After a wonderful journey through Siberia, the account of which may still be read with thrilling interest, he arrived safely at Petropavlovsk, whence he set out, still on foot, to perform a tour of the peninsula of Kamchatka. Crossing the peninsula to Bolsheretsk, he followed the west coast northwards to Tigilsk, whence he returned to Petropavlovsk by the Yelovka and Kamchatka rivers, and concluded his adventurous explorations by bringing a Kamchadale lady to England as his wife.

A few years later (in 1826) H.M.S. *Blossom*, under the command of Captain F. W. Beechey, R.N.,[15] spent a few days—June 27th to July 5th—in Avacha Bay on her way to Bering's Straits, and touched at Petropavlovsk a second time on her return journey (July 3rd to 20th, 1827).

Few travellers have seen more of Kamchatka than the German naturalists F. H. von Kittlitz[19] and Adolph Erman,[17] of whom the former travelled extensively in the country during the years 1827 and 1828, while the latter visited pretty nearly the whole peninsula in 1829. Entering it at the Tigil, he crossed the mountains to the valley of the river Kamchatka, where, having inspected the main volcanic region, he journeyed to the extreme south of the peninsula, and finally ended his travels—where most people had begun them—at Petropavlovsk.

Of late years one or two travellers have continued the work begun by the older pioneers, and we have a most painstaking work by Karl von Ditmar,[29] whose minute examination of the country took place during the years 1851 to 1855, although his book (and that only the first volume) was not published until some forty years later. We have also a few notes on Petropavlovsk, Avacha Bay, and its neighbourhood from the pen of J. M. Tronson, R.N.,[20] who took part in the avenging expedition of 1855.

On July 24th of the same year [1855] the United States store-ship, *John P. Kennedy*, arrived off the western coast of the country, and for an account of her voyage northwards, and the unsuccessful coal-mining operations of her crew, we are indebted to one of her officers, Lieutenant A. W. Habersham.[18]

Five years later (in September and October 1860) another Siberian voyager, P. M. Collins,[21] spent a few days in the Petropavlovsk district, and was fortunate enough to witness an eruption of Mount Avachinska, during the course of which, as he writes, a section of the cone to the north was broken off, "making a large notch where before it was rounded."

To Frederick Whymper,[22] an employé of the short-lived Russo-American Telegraph Company, we are indebted for an account of his visit to Petropavlovsk in 1865, while one of his colleagues, George Kennan,[23] has given us a most spirited and graphic description of the journey of a party of the Company's explorers in the autumn of the same year from Petropavlovsk to the river Kamchatka, and thence to its junction with the Yelovka river, up which the party travelled and crossed the mountains to Tighilsk, the adventurous journey not, however, terminating until they had passed right through Kamchatka, and had

left the peninsula behind them *en route* for Gizhiga. Kennan's journey was a hurried one, but he passed almost through the whole length of, as well as right across, the peninsula, and his descriptions of its varied features are among the most realistic I have read, in particular, that of the volcano Kliuchevskaia, of the mountains and elevated moss-plateau near Tighilsk, of the mountains between the Tighil river and the steppes of the wandering Koriaks, and, lastly, of life among these and among the settled Koriaks.

Another work of the same period is that of Richard J. Bush.[24] Few of these travellers, however, were scientific men, and our literature of the country in the English language is still exceedingly meagre. The works of Dobell and Kennan abound with sentences which mark them as keen and accurate observers, but it is to F. H. H. Guillemard that we must turn for the most recent scientific English account of the country by a professed traveller, although his journey from Petropavlovsk down the Kamchatka river, and his sheep-hunting expedition to Cape Kronotski, cannot be said to have touched new ground.

Quite recently Petropavlovsk has been the subject of several flying visits on the part of the various Commissioners or agents employed in the investigations connected with the fur-seals of Bering's Sea, and it is to his connection with these that the present writer owes his good fortune in having been able to visit the country. Lastly, the expedition under M. Bogdanovich, which explored a large part of the country last summer, will no doubt add considerably to our knowledge.

The little that we know about Kamchatka is sufficient to enable us to form some idea of its exceeding interest, whether to the scientist, the sportsman, or the student of geography. Geologically speaking a comparatively new country, where the forces of denudation have not yet had time to blunt the boldness of its magnificent scenery, it possesses a lengthy series of active volcanoes of unrivalled grandeur, the northern outliers of the mighty chain which, stretching southward through the Kuril Islands, Japan, the Liu-kius, Formosa, the Philippines, and Celebes, reaches its termination in the dreaded Tambora, the curse of the island of Sumbawa.

To the sportsman it must always be a well-nigh ideal hunting-ground, whether he prefers to pursue that king of game-birds, the capercailzie, in the woodlands, or to lie in wait for the burly Kamchatkan bear as he descends the hillsides to feed on the salmon which crowd every river, to climb the mountains in search of wild sheep or reindeer, or be content with humbler game, such as willow grouse or ptarmigan, or the innumerable flocks of water-fowl which frequent the rivers and estuaries.

For the naturalist the land of the sea-otter, the walrus, and the fur-seal must always possess a more than ordinary attraction, while the anthropologist must find a rich field for study amongst the now harmless natives, whose mild and primitive habits and strange dwellings are of the highest interest, especially as their dwindling numbers show that their days as a separate race are numbered, under the combined influence of intermarriage with the Russians, of drink, and of disease.

Yet with all this rich field of interest, the country is, as a whole,

cursed with a climate, such that, good though it is for Eastern Siberia, except for a brief summer interval, when indeed the sun's rays are pleasantly warm, storm and fog here have it all their own way.

Subject to the still furious typhoons which during the autumn rush northwards from the China Sea, peace does not come to it as to the more southern regions on the cessation of the typhoon season, for during the greater part of the winter months a series of terrific snowstorms sweeps over the peninsula, burying or freezing to death the unfortunate travellers whom they may catch on their way. Even the summer months may be shorn of their sunshine by the alternating gales and fogs, involved by a too near proximity to Bering's Sea. The winter frosts, on the other hand, are not nearly so intense as those of Siberia generally, and between the storms there may be quite enjoyable weather.

The rocky coast, too, possessed as it is of a single harbour, however grand it may seem to the eyes of a traveller, must ever be a source of terror to the navigator, while during the short-lived summer months life inland is rendered almost unendurable by the clouds of persecuting mosquitoes, whose untiring efforts to obtain a drop of human blood drive a stranger to despair. For the man of business, indeed, Kamchatka possesses few attractions, for with a climate almost fatal to the growth of corn,* except in some of the more sheltered valleys, such as that of the river Kamchatka, its main or only wealth, unless it should some day prove another Klondyke, must ever consist of fish, of furs, and perhaps, to a limited extent, of timber.†

But I shall perhaps give a better idea of the country if I describe my first visit to it—an occasion on which I saw it at its very best. It was on July 14, 1896, that I first arrived at Petropavlovsk in H.M.S. *Spartan*. We had visited Robben Island, a small reef and rock off Sakhalin, had inspected its fur-seal rookery, and on leaving it had spent some twenty-four hours crossing the chilly waters of the Okhotsk Sea, seeing neither sun nor star nor ship in the dense fog which enveloped our path. Only once, namely at noon on the morning of the 13th July, did the fog lighten for a brief moment to show us, as if in a moment of repentance, Amphitrite Pass, between two of the Kuril Islands, and we could make out a fine cape to the southward, on which the snowdrifts lay right down to the level of the beach. Helped by this opportune if fleeting vision of a dreaded region, we passed safely into the Pacific, where the dull damp fog, as if repenting of its temporary relaxation, again enveloped us in its clammy grip.

All that day and during the following night, by constant use of the lead, the vessel was kept outside the 100-fathom line, until at half-past two o'clock, on the morning of the 14th, we suddenly emerged from the fog almost like a train from a tunnel, our experience in this respect coinciding very closely with that of Guillemard. At that time we had left the Kuril Islands well behind us, and were about abreast of Cape Lopatka, the southern termination

* Potatoes, turnips, radishes, and rye are grown at some of the villages.

† Larch and birch only—little pine or fir.

of the Kamchatkan peninsula. Here commences a great range of mountains, which running parallel to the axis of the peninsula cuts off the waters of the Okhotsk Sea from those of the Pacific Ocean. The officer of the middle watch on the *Spartan* enjoyed a splendid view of this country as it gradually opened out before us, peak stretching away beyond peak towards the north-western horizon. The day, at first bitterly cold, grew warmer as the sun rose higher in the sky, and from four or five o'clock our progress up the coast towards Petropavlovsk was made under the most delightful conditions possible. Blessed with the accompaniments of a bright sun and a calm sea, one of the grandest coast-lines in the whole world gradually unfolded itself to our view, the glittering snowclad mountains contrasting sharply with the dark green or purple precipices, themselves in striking contrast to the swelling waves which heaved below their base.

The giants of the Kamchatkan mountain system were not as yet within our view. These reach their climax in Middle Kamchatka, in an area visible from the valley of the lower Kamchatka river, where the country, here swollen to its greatest breadth, has permitted them to assume a more complicated arrangement than would be possible in the narrow region south of Petropavlovsk. Nevertheless, the southern mountains, though not of extraordinary height, are boldly peaked, and seen, as we saw them, from the sea, are a sight such as can but seldom gladden the eyes of a traveller. The most southern mountain of any note, Mount Ozernaia, we passed at a very early hour. Further north are the shapely sisters Povorotnaia, the mountain of the Turning Point (7932 feet), and Viliuchin (7372 feet), the latter a beautiful snow-clad cone.

Right ahead, and lying just behind Petropavlovsk itself, there gradually opened out to our view Koriakskaia (11,554 feet), Avachinska, and Kozelskaia (9058 feet), the second an active volcano; while farther north again, a good deal beyond our horizon, the range culminates in a series of noble cones—the highest of all, Kliuchevskaia (16,988 feet), it was never my good fortune to behold. Of Koriakskaia and her sisters, Avachinska and Kozelskaia, we had a very good distant view, but the more northern peaks were hidden from our eyes by the mist, which later in the day crept down and enveloped also the summits of the nearer mountains.

All along this southern Kamchatkan coast-line we could see the snowdrifts still lying close down to the level of the sea, and it was to the melting snow, no doubt, that the waves owed their dull leaden colour. High above the swell stupendous cliffs towered to a giddy height, and every now and then we passed huge sheer precipices, formed apparently by the bisection of a mountain at one clean cut, the rocks composing their faces being often of very beautiful red or green colours. Here and there, especially in and about Avacha Bay, were strange-looking cigar-like or pinnacle-shaped rocks. Standing on end, their bases buried in the sea, they looked as if almost undermined by the waves, and seemed to need only a touch to make them topple over into the water. Many a tempting cove and inlet we passed, where, it seemed,

a boat could easily have landed on the pebbly beach; and visions of expeditions in pursuit of bear or other game over the moors and hill-sides stretching away into the interior of the country made the sportsmen of our party long to reach the end of their journey.

Our introduction to this fine country was certainly made under exceptionally fine conditions, for, although on our arrival at Petropavlovsk we were told that that village had already enjoyed four days of continuously fine weather, we well knew that for about nine months out of the twelve these moors and mountains are subject to the thrall of rain and mist, or snow and ice.

Not a few interesting sea-birds were observed during our voyage up the coast, a strange mixture of new and unfamiliar species with those which are the old friends of every British ornithologist. The marine sub-arctic bird-life of Bering's Sea consists in fact of three elements, of which one includes a set of forms found all round the northern hemisphere, and here identical with or only sub-specifically distinct from those we know so well in the Atlantic. Such are, among the Gulls, the Red-legged, the Common, and the Kittiwake, and, among the Auks, the Guillemot, all of which are as much at home in Bering's as in our own seas. Other familiar birds of the north, such as the Shag, Cormorant, Black Guillemot, Puffin, Shearwater, Fulmar, and Scoter are represented by more distinct, but yet (except to a specialist) not widely different, species. This division has a corresponding element among the mammalia, including, as it does, the Floe Rat, Greenland, Bearded, Harbour, and Pacific Seals, the Walrus, and, among the whales, species which correspond to the ordinary representatives of the order in Atlantic waters.

The second element consists of forms not found in the North Atlantic, which have obviously found their way northwards from their true home in seas south of the Equator, and among which I may note the Albatrosses (*Diomedea albatrus* and *D. nigripes*), the Fur-Seal, the Sea Lion, and the extinct Steller's Sea Cow of the Commander Islands.

Thirdly, and in some ways the most interesting of all, we have a group of peculiar genera and species, which seems to have been evolved in these particular waters, and which include, among mammals, that most prized of all fur-bearers, the Sea Otter, that most beautiful of all seals, the Ribbon Seal, and among birds, that most elegant of gulls, the Bering's Sea Kittiwake, *Rissa brevirostris*, readily distinguishable from our own species by its beautiful coral-red legs, its short beak, dark mantle, large eye, and quite distinct voice. Lastly, among the Auks we find a whole hierarchy of strange and peculiar forms, from the great Black Puffin with his brilliant red and yellow beak, and buff nuptial plumes, to the numerous pigmy species and genera all provided with strange seasonal developments of beak or facial plumes, and which seem to find a rich feeding-ground in these, to us, seemingly cheerless waters.

Among conspicuous absentees may be noted the Great Grey Seal of our own Scotch and Irish waters, the Razorbill, which breeds in summer on our rocky coasts, and the Little Auk which the gales of winter sometimes drive in scores upon our beaches.

Similarly among fish we find familiar species such as the Herring, Cod, Halibut or Stickleback, side by side with strange genera such as *Onchorhynchus*, to which belongs the North Pacific Salmon, wherein nature seems, as among the auks, to have tried her hardest to produce as many different variations as possible out of the same material.

Towards 3 P.M. we approached the narrow entrance of Avacha Bay, inside whose shelter lies the capital of Kamchatka, Petropavlovsk, the city of St. Peter and St. Paul, whose high-sounding title would almost lead the traveller to expect a second St. Petersburg.

Such was my first experience of Southern Kamchatka. My second was of an exactly opposite nature. It was in August 1897, and I had come from Karaginski Island, which lies off the north-eastern coast of the peninsula, and whither I had journeyed in H.M.S. *Linnet*. We had left Karaginski Island on the 24th, and had had a fair passage until the 26th, when a dirty night set in, with wind and rain. The morning of the 27th opened with rain and mist and some sea, and although we could occasionally catch glimpses of the coast, we dared not run in close, but steamed slowly along, trying to find the entrance to Avacha Bay. Unpleasant visions haunted some of us of a lively twenty-four hours spent by the same vessel at the same place in 1896, when in the tail-end of a typhoon, and on a lee-shore, it was impossible to find the entrance to the harbour, and the little ship, forced like the *Calliope* at Samoa to run out to sea, had more than difficulty in riding out the storm, and her engines were hard put to it to keep her off the land. On the 27th, however, our good luck did not desert us, and a very characteristic flat-topped rock having betrayed the entrance to the harbour, we steamed into Avacha Bay, passing the entrance at about half-past ten o'clock, and dropping anchor about noon at Petropavlovsk.

Avacha Bay, the only harbour worthy of the name in all Kamchatka, must be ranked among the foremost roadsteads of the world. It is a spacious loch almost circular in shape, and has a diameter of about ten miles in every direction. Formed at the bottom of a larger bay of the same name, it communicates with the sea only by a somewhat narrow entrance; when once this channel has been found and passed, a ship may find inside as good an anchorage and shelter as could well be wished. Running inland from the harbour itself are several large ramifications, the principal of which, Tarinska, lies to the south, and just opposite to the town of Petropavlovsk. This, as well as that known as Rakova (Crab) harbour, was explored by us during our two visits. Avacha Bay is lighted by a lighthouse built on the headland just north of the entrance, which is marked also by several very characteristic flat-topped rocks, the breeding-home of numerous gulls. It was to one of these flat-topped bird-rocks that we owed our safe making of the harbour on the 27th August 1897.

The country in the immediate vicinity of Avacha Bay is not ruggedly mountainous, and to its shores slopes down an undulating, thickly-wooded region, with many streams and low-lying marshes, where in summer the inhabitants manage to steal a crop of coarse hay, and in which lagoons and ponds abound. In the woods the undergrowth is exceedingly thick

Group of Inhabitants of Northern Kuril Islands: a mixed race, which has arisen probably from the intermarriage of Ainus and Kamchadales.

Avacha Bay and Petropavlovsk Harbour from the hill behind the town.

For several of these photographs I am indebted to the kindness of Messrs. H. O. Jones, N. N. Lukeen, and H. J. Snow.—G. E. H. B.-H.

Petropavlovsk from the Wharf.
(*Boat in foreground not Kamchatkan but Japanese.*)

An *Isba* or house of a Russian at Petropavlovsk. In the foreground is the householder, with his sledge and team of dogs.

and luxuriant, and progress through them is far from easy; yet in the neighbourhood of Petropavlovsk there are no very large timber trees, or, if any such ever existed, they have been cut down long since, for in Kamchatka any one may cut timber. A park-like country, in the immediate rear of the village, may possibly have been cleared of its timber by the needs of the townsfolk from time to time, and the remains of stumps still in the ground may possibly indicate this. Its main features are now small trees, patches of scrub, and many intervening grassy spaces.

On the whole, the vegetation is not unlike that which we are accustomed to see in the north of Europe. The trees are of no great size, and include species of alder, willow, birch, poplar, a dwarf pine, and a good deal of a species of mountain ash, which on Bering's Island occurs only as a small and stunted shrub. Ferns grow luxuriantly, as well as such well-known plants as tansy, avens, bracken, monkshood, gentian, meadowsweet (*Spiræa*), saxifrage (*Saxifraga*), wild roses (*? Rosa Kamchatkica*), wild pea (*Lathyrus*), and a bright blue geranium, the latter, perhaps, the most conspicuous wild-flower in Kamchatka and on the Commander Islands. Berry-bearing plants of several kinds are exceedingly plentiful, and their luscious fruits are greatly prized by the inhabitants, whether Russian or Kamchadale.

Geologically the neighbouring country has been examined by Dr. G. M. Dawson,[25] who thinks that not only the dominant volcanic cones, but the irregularly mountainous or hilly country of lower elevation which surrounds them, may have been largely volcanic in origin; but if so, it has now "been denuded and sculptured into ordinary systems of hills and valleys, like the mountains of most of the Aleutian Islands already described, probably in Tertiary times. There is also, along this part of the coast, evidence of a plane of marine denudation," particularly at Cape Shipunski.

Petropavlovsk (the city of St. Peter and St. Paul), the modern capital of Kamchatka, lies on the north side of Avacha Bay, and is the possessor of a secure anchorage for ships, as well as an inner shelter for boats, formed by two of the curious promontories and sandspits, which, in this case running out in opposite directions, are one of the peculiar geographical features of Kamchatka.

The entrance of a ship into this harbour, through the narrow channel marked by buoys, has been graphically described by Guillemard. Within almost arm's-length of the land there is water deep enough for the safety of quite a large ship, and the *Spartan* had no trouble in entering by the tortuous passage. The only port in Kamchatka—or, in fact, on the western side of Bering's Sea—the harbour is seldom without a steamer or two in summer. The Russian Government keeps a quantity of coal here, to obtain a supply of which the cruisers of the sealing patrol are constantly entering. There is, besides, a regular mail-steamer from Vladivostok, as well as vessels which come up in connection with the fur and fish trade.

The town itself—or village, for, despite its resonant name, it is nothing more—is grass-grown, sleepy, and of little importance, except as a centre for the export of furs. The houses are built of logs, with

enclosures of wattle or stakes, and there are many stores; under the eaves we saw nests of the Brown-Bellied Swallow, *Hirundo tytleri* (Jerd.). These birds had already left for the south by August 27, 1897. A Russian church with the usual quaint cupola, a house for the chief representative of the Government, and the offices of the Russian Fur Seal Company, are all arranged so as to form the roughest kind of street, on the slope of a hill close to the lake's side. There is no sign of the curious summer and winter habitations for which the Kamchadales are celebrated, and which are figured in Cook's third voyage; and the inhabitants, at least in summer, are all clad in garments of rough European make.

The place has indeed changed much since it was visited by Cook's expedition, at which time, according to James King, the town * built on the spit consisted of nineteen balagans, three yurts, and seven log-houses, the latter being an innovation made by the Russians.

Petropavlovsk seems with difficulty to have survived the little-known action of August 24, 1854, in which a mere handful of trappers, Cossacks, and natives defended it so brilliantly against the attack of a party landed from a combined French and English fleet of six sail, with a loss to the invaders which the lowest estimate puts at over a hundred men. Surprised at their own unexpected victory, and fearful of reprisals, the inhabitants are said to have deserted the town in the following spring, so that the avenging expedition of the year 1855 encountered no resistance to its approach.

For a place of its extent the city of St. Peter and St. Paul is well supplied with monuments to remind one of its history, and the names of the famous men who have visited it. On the sandspit is a column in celebration of the victory of 1854. In a pleasant grove a picturesque inscription † on a stone recalls the famous navigator La Pérouse, while to the ill-fated Vitus Bering, the unlucky discoverer of the Commander Islands, a pillar has been erected. The graves of the seamen who died in the action are protected by a railing and are as well tended as those of their Russian foes who lie beside them; while on the other side of the bay at Tarinska harbour, in a space of ground recently enclosed by order of the English Admiralty, lie the bodies of four officers of the invading party, including Admiral Price, who, however, according to some accounts, is said to have died on the day previous to the action. Another monument, that of Captain Clerke, the successor of the famous Captain Cook, although it existed at the time of Beechey's visit, has disappeared. Its weed-grown site was pointed out to Whymper in 1865 (p. 95).

Besides its interesting monuments the village boasts of many magnificent views. Standing on the hill among the log-houses on a fine day one can look across the wide expanse of Avacha Bay, with its bewildering maze of smaller lochs. Right opposite the snow-clad peak Viliuchin glitters in the brilliant sun, while around it a plentiful

* There was no trace of the town on the spit in 1865 (Whymper).

† Replacing a hideous monument, said to have consisted of a wooden frame covered with sheet-iron, painted black, and bearing no date or inscription, as seen by Kennan in 1865.

crop of bare minor cones show what an oasis in this rugged country the neighbourhood of Avacha really is. Looking in the opposite direction, Koriakskaia gleams through a gap in the dark hillside, and if one ascends the hill behind the town she and her two lofty sisters, Avachinska and Kozelskaia, seem on a clear day to laugh at distance and almost overshadow the bay, a light puff of smoke just arising from the summit of Avachinska, while the dark wooded hills in the immediate foreground serve to throw into contrast the shining summits of the volcanoes. More usually, however, they sulk behind a thick veil of cloud or mist, and only deigned to show themselves to us twice during our two visits, and then only for a few minutes at a time.

An interesting afternoon may well be spent among the log-cabins and stores in the town. In the main store of the Russian Fur Seal Company may be seen the almost priceless furs of the country. Here are immense bearskins from the interior; there hang a thousand prime sables of well-nigh incalculable worth; here a bundle of bright red fox-skins from the north, or of the smaller but more valuable blue fox from the Commander Islands or the Arctic tundras, will fetch an untold number of roubles. Grey squirrel and land-otter and glutton are here in abundance, and you may find a few skins of the now almost mythical sea-otter from Cape Lopatka, or the product of the carefully guarded rookery of Copper Island.

Even in the smaller stores you will find not a few fine heads of the Kamchatkan Bighorn, *Ovis nivicola* Eschs., of reindeer, of hair-seal, of bear, and of the mighty Pacific walrus, whose enormous, often unequal, incurving or crossing tusks, so different from those of the Atlantic species, are brought down by the hunters from the coast near Cape Kronotski.

Nevertheless, as in all countries where a powerful company is in the possession of almost exclusive rights to trade or hunt, we found the value of each fur is so well known that a market price was affixed which could not be reduced by bargaining—a price in some cases far above the limit to which we cared to go. Still a few purchases were made, among which, perhaps, the most notable was the head of a fine male walrus, the tusks weighing 7 lbs. 10½ oz. and 6 lbs. 10 oz.,* and which after a long delay in go-downs at Chinese ports was the first of its species to reach the collection in the British Museum. Very few skulls of this fine animal seem to have reached Britain, and so I was anxious to procure a set of heads for the various museums, for in Kamchatka the hunters seem to have a custom of bringing in many of the heads of the fur-bearing animals which they kill. So in 1897 an intimation was given to the walrus-hunters that they would find a ready market for all the heads they might bring in, and the party who set out to kill walrus at Cape Kronotski promised to get us a number. Setting out in an open boat these men spend a few weeks at the rookery for the special purpose of killing the walrus, and then return carrying their heavy booty with them. They had been helped on their way northwards by a friendly tow-rope from the *Linnet*, and we looked out for them again at sea on our voyage

* In the *Field* of March 25th Professor D'Arcy W. Thompson writes that in Kamchatka in 1897 he obtained a pair of walrus tusks which weigh 8 lbs. and 8¼ lbs. respectively, and measure 2 feet 10⅜ in. and 2 feet 7⅜ in.

from Ukinsk Bay to Petropavlovsk, at which time they should have been returning, but their boat was not to be seen, and did not actually arrive home until about three days after we had left Kamchatka. Mr. Jacobleff, the sub-agent of the Russian Fur Seal Company, wrote me that fifteen heads had been brought down, but that the men were too poor to wait for money sent them from England; and so I lost my walrus heads.

The politeness of the people of Petropavlovsk is, next to their laziness and love of holidays, perhaps their most conspicuous quality, and at every house a foreigner is received with the greatest civility. In the street they invariably salute a stranger with the hand, and in every way are exceedingly obliging; but they hate work as they love good company, and there being here little need and consequently little incentive to accumulate money, it is difficult to get them to work except as for a friend. Light-hearted and merry, they will not brook harsh treatment, but must be dealt with as equals, if their assistance is required. Accustomed to hard spells of toil and exposure when either fishing or trapping they love to take things easy when they can; and on fine summer days, while the men loaf about the streets or in the stores, the woods for miles around Petropavlovsk resound with the merry voices of berrying or picnicking parties of women and children.

At Petropavlovsk, as I have already stated, little or nothing is to be seen of the former native inhabitants of the country. They have either died out, or have become so mixed with the Russians that they are practically non-existent; and the blue eyes and fair hair of the townsfolk are very far from bespeaking the Kamchadale inhabitant. Even the *balagan*, the famous beehive-like summer dwelling-place of the Kamchadale, has here degenerated to a mere storehouse, so that one gains little real knowledge of the original inhabitants of Kamchatka as King, Steller, Krasheninnikof, Langsdorff, De Lesseps, and Dobell saw them. Petropavlovsk is in fact at the present time a mere Russian village, a little piece of Russia proper transplanted to the extreme end of Eastern Siberia.

During our first visit we spent very little time at Petropavlovsk itself. Fresh as we were from Japan, with its wonderful art, its peculiar and, to a European, novel civilisation, and the other sensational attractions of that unique country, we found little to appeal to us in the unpretentious little collection of log huts and cabins nestling under the hillside north of Avacha Bay. Strangers to the people, uncertain as to whether we should be treated with friendship, indifference, or suspicion, and everywhere pursued, even on board ship, by the persistent attentions of a cloud of mosquitoes, we stayed only long enough to take in bread and meat for the crew, and then steamed across the loch to Tarinska harbour, a spacious amplification of the south-west of Avacha Bay, opening from it by a narrow channel near the slopes of Mount Viliuchin. Here, despite the mosquitoes and a heavy storm of wind and driving rain on the 16th, we passed a pleasant two and a half days.

For the bluejackets seining parties were organised, but out of the many hauls only one was successful, the net being generally weighed

down with quantities of a disgusting blood-red medusa, with which the water was full, even at this distance from the sea.

The thick woods which grow right down to the edge of the loch, though to all appearance a regular botanical paradise, seemed to be rather destitute of bird-life; but the very denseness of the luxuriant undergrowth prevented one from penetrating to any distance from the shore, or from seeing or securing specimens of the few small passerine birds whose notes could be heard in the bushes. In fact, bird-life was far more plentiful on the water than on shore, and we added very considerably to the list of water-birds which we had observed during our voyage up the coast.

To an ornithologist the avifauna of South Kamchatka presents several points of interest, not only for its familiar but for its unfamiliar features. True, much of it is similar to that to which one is accustomed in northern Europe, many of the Kamchatkan land birds being merely representative species or sub-species of those of our own country. Mixed with these, however, is a proportion of forms of Eastern or American derivation, while another section includes birds which appear to be peculiar to, and the offspring of the peculiar conditions prevalent in, the peninsula. Lastly, the avifauna is remarkable when compared with our own, as much for what it has not as for what it has got.

Thus the Magpie and the Carrion Crow are here as evident as in England, but one misses the familiar forms of Rook, Jackdaw, and Starling. Again, whereas a Swallow very similar to our own builds its nest under the eaves of the houses, no Sparrow of any kind exists to torment him with its vulgar chatter or to drive him from his home. Side by side with these exist birds of novel form and hues, such as the Kamchatkan Titmouse and Cuckoo, the falcated Teal, a peculiar Nuthatch, the beautiful Pallas' Sea Eagle, and a peculiar white Goshawk.

A point of considerable interest in connection with the few species or subspecies which are peculiar to the peninsula is the fact that, in the words of Dr. Leonhard Stejneger,[26] "all the peculiarly Kamchatkan birds possess a greater amount of white than any of their allies, wherever these may reside. So extreme is this tendency towards whiteness that one species, *Astur candidissimus*, has become entirely white, while another, *Parus kamtschatkensis*, is nearly so."

The most striking absentees among birds, besides those already mentioned, are Pigeons, Herons, the Jay, Dipper, Gold-crest, Tree-creeper, Lapwing, Land-rail, Quail, Kite, Wren, and the Harriers, while amongst mammal we here look in vain for the Red deer.

One of the most striking features in the general natural history of Kamchatka is the intermingling of Arctic forms with those which we are more accustomed to associate with the sunny south. Thus, the call of the Cuckoo and the twitter of the Swallow may here be heard in the valleys which overhang waters wherein the ponderous walrus disports his bulky form. The weird drawling cry of the Arctic Fox and the tapping of Woodpeckers salute the ear in strange incongruity from the same region, while the reindeer browses contentedly in a country

which supports cattle and wild sheep. In Kamchatka, in fact, the abundance of high ground running down directly from, and never losing its connection with, the most northerly regions of the earth, allows animals such as the Arctic Fox and Reindeer to live in much more southern latitudes than is their usual wont, and these creatures find in the mountains a ready refuge from the heat of the summer months.

It is to the existence of the same high ground that is due the great southern dip of the Arctic tundra in Kamchatka, and the failure of trees in an unusually southern latitude.

Good sport was not to be obtained at Petropavlovsk in the summer months. For reindeer and bighorn a journey of two or three days into the mountains was said to be necessary, while the bear were inaccessible in the thick undergrowth. Later in the season some of the officers of the *Linnet* found Capercailzie, *Urogallus parvirostris kamtschaticus* Kittl., and Willow-Grouse, *Lagopus lagopus* Linn., within walking distance of the town, but, as a general rule, in Kamchatka a sportsman must not expect to get much return for his trouble except in spring or autumn. In summer the mosquitoes are rampant, and the thick undergrowth serves the double purpose of effectually concealing the game and of obstructing their pursuer, while in winter the snow lies so thickly that the bears, at all events, are safely asleep beneath its sheltering mantle.

To the traveller who wishes to visit the interior, or the western coast, of Kamchatka, two alternatives only are open. If he has the pluck to face the mosquito legions in summer-time, he must ride from ostrog to ostrog, as the villages are called, through the birch woods on a Kamchatkan pony; if he prefers to experience the blinding snowstorms of a northern winter, then he must travel by dog-sledge. There are no roads other than the rivers and the paths made by generations of bears, who, in this respect, would seem to be ahead of their enemy and conqueror, man, for Guillemard saw a bear-path on the banks of the river Kamchatka, which followed the course of the stream for 500 miles.

By all accounts such travelling is, under favourable conditions, pleasurable enough; but the stranger's enjoyment even of the fine woods and mountains of Kamchatka is apt to be sadly marred by the frequent stampedes of the half-trained ponies, and the consequent smashing of all that is most fragile and most precious in his baggage. No very long journeys, however, are as a rule performed on ponies, the principal use of these animals being to carry passengers from the banks of one river to those of another. Once on the river-side the ponies are discarded, and the canoe, hollowed out of a tree trunk, bears the voyager quickly downwards, or, if he travels up-stream, he is poled or paddled along his way. Here a new danger besets him, should the canoe be old and leaky (as is frequently the case); moreover, unless he sits as still as may be, even a sound canoe is more than liable to capsize. Nevertheless, a very comfortable raft may be constructed on a couple of sound canoes lashed together, and this is perhaps the most luxurious mode of travelling in Kamchatka.

The pleasures and disadvantages of dog-sledging in Kamchatka have often been described by those who have experienced them. Like the

use of ponies, this method of travelling can, given good weather and hard snow, be not unenjoyable; but the scent of a wild animal will at any time send the dogs into hysterics, and the chances—especially on such occasions—of a violent collision with a tree or rock are more than probable. For, once excited or left to themselves, a team of dogs will race onwards until their aching limbs will carry them no farther, and at length they drop from sheer exhaustion. Yet it is a pretty sight to see a trained leader of a team turn to right or left, or stop dead at the simple word of his driver, who, if a dog disobeys a command, hurls an iron-shod staff at the culprit's head, and then by a kind of acrobatic feat stoops down and recovers this instrument of chastisement as the quickened sledge whirls onwards.

We had intended to have left Tarinska harbour for Bering's Island at 4 A.M. on July 17th, but the fog and wind of the previous day, and the almost certain prospect of a dusting at sea, induced the captain to delay our start until 5.30 P.M., when the weather, although dull in the morning, was looking more promising. I therefore had the benefit of a few more hours with my gun on shore at Tarinska, where, however, short as my experience was, the mosquitoes gave me such a hot time of it that I was not altogether sorry to leave a country where in summer they reign supreme. Individually not so poisonous as the mosquitoes of the Tropics, they make up in diligence for their comparative lack of venom, and neither man nor beast, European nor native, enjoys any peace while they are about. The bluejackets, whose bare feet seemed to have a special attraction for the insects, suffered most of all, as we ourselves escaped such biting by wearing long boots. Yet the warm days when the mosquitoes are most troublesome are the very ones on which it is well-nigh impossible to cover one's head sufficiently; and there were few of us indeed whose faces were not swollen from the irritation caused by their numerous bites. The prospect of a voyage at sea to clear the ship of mosquitoes was therefore a pleasant one, but the irritation caused by the bites did not subside for some time after we had left our tormentors behind us, and it was some days before we had forgotten their attacks.

Such is Lower Kamchatka, its people and scenery. Of Middle Kamchatka I have here nothing to say, except only that it is Kamchatka at its best—the very essence, in fact, of the country; a land of fish and fowl in abundance, of bears and berries and richly-furred sables, of birch and larch woods, of peaceful, well-watered meadows, and hot springs overshadowed by awe-inspiring live volcanoes; a land full of romance and variety, where every nook, and rock, and corner is peopled each by its own presiding spirit in the imagination of the simple Kamchadale aborigines. Although I passed down the whole coast-line in the *Linnet*, its glorious mountains steadfastly refused to reveal themselves to my gaze, and the few uncertain glimpses of their outline, which the Bering's Sea mist vouchsafed to me, gave me no idea whatever as to their real shape and proportions. They have, however, been more than once, and that well, described, in particular by Guillemard, to whose excellent account of the valley of the river Kamchatka I must refer my readers.

A very different region is Upper Kamchatka, and it is here that the most unknown part of the peninsula lies, much of the coast appearing on our Admiralty charts as a dotted line. In fact, there is probably no coast in the whole northern hemisphere outside the Arctic seas so little known as that part of Ukinsk Bay which faces the island of Karaginski.

From Cape Lopatka in the extreme south of the peninsula to Ozerny Mys (Cape) at the entrance to Ukinsk Bay this magnificent country continues to exhibit one almost unbroken series of internal mountains sloping eastwards to a rugged, iron-bound coast, its outline hardly indented by a single inlet of any commercial importance, and with only one harbour fit to receive a ship. Only one river of any size, the Kamchatka river, here finds its way to the sea, and the value of this to a navigator is destroyed by the presence of a shallow bar at its entrance. All the other rivers of any consequence enter the sea of Okhotsk on the western coast-line of the country.

The latter coast is, according to those travellers who have visited it, strikingly different from that which borders Bering's Sea. It is, for the greater part, flat, the land only rising towards the mountains at a distance of twenty-five to thirty miles from the sea. Its geology has been studied by Erman, who states that it "is composed of Neptunian, Secondary, and Tertiary rocks."

Northwards of Ozerny Mys, however, a change is at once visible, and from this point, at which Upper Kamchatka may be said to commence, the country, which has farther south swollen to its fullest width, becomes narrowed preparatory to meeting the moss-steppes and tundras of the wandering Koriak and Chukchi tribes. Not only is the country narrowed, but the mountains are here reduced in size, and retire inland from the coast of Bering's Sea until they directly overlook the waters of the sea of Okhotsk. Like the mountains, the eastern coast-line also loses its grandeur, and, gradually becoming flatter, runs through all the various intermediate stages, from precipice to cliff, from cliff to escarpment, from escarpment to low beach, by the time it has reached the Karaga river in about latitude 59° N. The western coast, on the other hand, now losing its flatness, becomes more worthy to rival the rockiness of the eastern.

Inland the country now becomes desolate in the extreme, and the forests and meadows of Middle Kamchatka rapidly give place to boundless marshes and rolling bush-grown moorland, an intermediate region which passes almost insensibly into the treeless tundras, the main vegetable products of which, besides the rich rank grass of the short sub-Arctic summer, are the Siberian dwarf cedar pine and the reindeer moss, between them almost the sole food of the reindeer and fuel of the Koriaks, who pasture their herds in that region.

Such was the country which, on the early morning of the 21st August 1897, I saw from the deck of the *Linnet*. On the previous evening we had approached Cape Ozerny, and had had a lively reminder of the perils which beset an uncharted coast. No dangers are marked on the chart in connection with the headland in question, and we could have well dispensed with our first geographical discovery in this region

—namely, that a dangerous and hitherto unreported reef runs out from this cape for a distance of about one and a half miles in a north-easterly direction. Fortunately for us the reef was on this occasion very evident, owing to the huge sheets of water and spray which a heavy swell hurled sometimes to a height of thirty or forty feet into the air. To see it once was enough, and we stood out to sea to await the daylight before attempting to gain any further knowledge of this dangerous coast.

As good luck would have it, the 21st was a brilliant, clear, and warm day, and we were not long in crossing the eighty miles of water which lies between Ozerny Mys and the Karaga river. As we ran up the channel we very soon got into calm and shallow water, and the soundings, which at the entrance had showed bottom at ninety fathoms, gradually decreased to ten fathoms as we neared the mouth of the river.

As soon as the morning mist cleared off the land we obtained an excellent view of our surroundings. Almost to the southward lay the entrance to the bay into which we had passed, the mainland there being high, and showing some very finely-peaked mountains. Farther to the north the central mountain chain bounded our horizon, and between it and the sea there stretched a dreary waste of undulating, bush-covered moorland, gradually rising as it neared the mountains. These are, for Kamchatka, of apparently no great height, and the loftiest summits did not appear to exceed 4000 feet. Yet they were boldly peaked, and outlined in a manner exactly like the higher cones of the southern part of the peninsula, to which they were only inferior in respect of their lesser proportions. There was but little snow remaining on the slopes exposed to our view, and if one may judge of this from the much greater quantity which was visible on the far smaller mountains of Karaginski Island, the western side of the range must be that on which the snow lies longest.

On our right lay Karaginski Island, the western slopes of its seventy odd miles of mountains plentifully besprinkled with scattered snow-patches. This, a long, almost torpedo-shaped island, runs parallel to the coast of North-Eastern Kamchatka, from which it is separated by Ukinsk Bay, a channel having a width varying from thirty to fifty miles. Bearing a striking resemblance to Bering's Island, it differs from it in the much lesser extent of its mountains.

Karaginski Island trends south-south-west and north-north-east: its northern extremity, Golenishchef Point, lies in about lat. 59° 15′ N., and long. 164° 41′ E.; its southern, Cape Krasheninnikof, in about lat. 58° 22′ N., long. 163° 30′ E. It has a length of about sixty-seven miles, exclusive of the reef which runs seawards for a distance of about six miles from Cape Krasheninnikof. This cape runs out as a long, low, narrow tongue of land not exceeding two miles in breadth, but northwards the island gradually widens until it reaches its average breadth of from fifteen to eighteen miles.

From the low southern point the eastern coast very soon rises into a range of mountains which probably do not exceed 2000 feet in height. Towards Bering's Sea and the north this range seems to terminate in a series of fine precipices, at the feet of which, probably, is the home of many seals and perhaps of walrus. Westwards the slope is gradual,

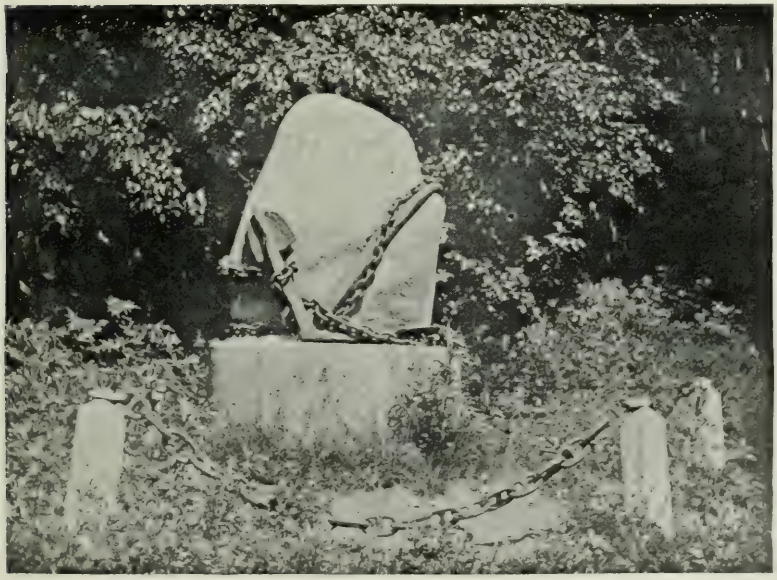
and ends in an escarpment, of a height of from twenty to thirty feet, and cut through in several places by some small streams, which issue from the undulating central portion of the island. Between the escarpment and the shingly beach there is in False Bay (Guba Lozhnykh Viestei), the spacious but deceptive harbour in which we afterwards anchored, a narrow strip of thickly grassed ground just raised above the level of the shingle. This strip expands northwards into a large marsh, which forms the north-western portion of the island, and is drained by a river running into False Bay. There are, we believe, one or two small lakes in the interior of the island.

I have read no first-hand account of Karaginski Island in any book on Kamchatka with which I am acquainted. Dobell's only view of it was gained in dirty winter weather from the ice of the mainland. He gives the following description of it as obtained from the Kamchadales: "Reindeer, black and red foxes, and wolves, are the large animals principally found on it, and there are fish and game in plenty, some good meadow-lands and tolerably good timber. It was once well peopled with Reindeer Koriakees and Kamchadales, whom the small-pox destroyed, with the exception of half a dozen families, who afterwards came and settled on the peninsula. The reindeer, left there without their master, became wild, and the island is now well stocked with them. In the summer months the inhabitants of Karaggee, and other ostrogs in the neighbourhood, go thither to hunt and fish, and collect the teeth of the walrus or sea-elephant" (p. 96). De Lesseps, who had previously travelled by the same route as Dobell, has also a few remarks on the island and its Koriak population, but, like Dobell, he was unable to visit it, and only got his information from the inhabitants of the mainland village of Karaga.

By noon we had anchored in the small harbour into which the Karaga river empties itself. The *Linnet* was probably the first man-of-war * of any nationality to do so, and her progress with two boats ahead of us, sounding carefully as we moved in dead-slow, was carried out with a caution sufficient to prevent the occurrence of any accidents. We found the harbour of fair size, but possessing little depth of water, and the bar at its mouth, on which the water shoals from five to three fathoms, must always effectually prevent the ingress of large vessels. Like several other Kamchatkan harbours, such as those of Petropavlovsk and Berevinskaia Bukhta, near Cape Shipunski, the latter described by Guillemard (p. 216, vol. i.), it is sheltered by a long pointed sandspit, which runs out for some little distance into Ukinsk Bay. Right inside this, and close to the shore, a second sandspit runs out in a nearly opposite direction, cutting off, except at one point, a considerable part of the inner harbour; and on this second spit a choppy sea sometimes breaks with considerable force. Thus the harbour is well protected, but a gale from the south-east might send in a sea dangerous to boats. There is good holding-ground on mud or sand, with an average depth of seven

* Russian charts of the Karaga harbour have since reached the Royal Geographical Society, so that a Russian man-of-war must have been there before us. (See *The Geographical Journal* for Dec. 1898, pp. 647, 648.)

Characteristic winter scenery of South Kamchatka; Mount Avachinska in middle background; river, store-sheds, and birch-bark canoes in foreground.



La Pérouse's Monument at Petropavlovsk.

Inhabitant of Karaginski Island (male).

Primitive underground winter-dwelling on Karaginski Island. The entrance is through the roof, which is reached by a ladder constructed out of a notched pole.

to nine fathoms after the bar has been passed. The *Linnet* anchored in four fathoms close to the sandspit, at a distance of one and a half miles south-east of the village.

The people of Northern Kamchatka constitute perhaps the most interesting object for study of the whole country; and it was therefore with great pleasure that we saw that we had been rightly informed as to the existence of a village at the mouth of the Karaga river. This, the ostrog of the Karaga, on one of the routes for sledges travelling to Okhotsk, was passed through by De Lesseps in 1787, and by Dobell in 1812 (p. 93), and is described by the former as "the last in the district of Kamchatka." The inhabitants showed by the presence of several half-breeds amongst them that they were not absolutely free from contact with the Russians, yet their dress and habitations were exceedingly primitive, and differed but little from those seen in the latter years of the eighteenth century in Southern Kamchatka by the members of Cook's third voyage. So that this village can have been but seldom visited, and it is unlikely that there are at the present day any less adulterated races in Kamchatka.

When first discovered by the Russians Kamchatka was inhabited by two distinct tribes, of which the Kamchadales were settled in the more southern parts of the peninsula, while the Koriaks, a wandering, reindeer-owning people, occupied the vast moss-grown tundras of the north. North again of the Koriaks and always at enmity with them, the Chukchi, another tribe of nomads, pastured their reindeer as far north as the waters of the Polar Sea, while south of Kamchatka, the most northern outliers of the Ainu people, inhabiting the long chain of the Kuril Islands, reached almost to within hailing distance of Cape Lopatka.

Clad in skins, armed only with spear or bow and arrow, and using only implements constructed either of stone or wood or bone, the Kamchadales seem to have been in a condition resembling that of our own English predecessors in the Stone Age. Their only domestic animal, a wolf-like dog, served them solely as beast of burden, and had not acquired the trusted position of the dog of civilisation either in the capacity of custodian or companion. The main portion of their food consisted of the salmon which a benevolent Providence sent to them annually in abundance, and which, when dried, served themselves and their dogs as winter provender. Besides the fish they ate berries, the bark of trees or leaves, and were, in addition, nothing loth to feed on the flesh of the bear, the whale, or seal at such times as the chase of these animals proved successful.

Their features and appearance were Mongolian, for they were undersized, swarthy, black-haired, broad-faced, scanty-bearded, flat-nosed, with small sunken eyes, thin eyebrows, and short legs.

They appear to have existed for a considerable time in the peninsula, had no tradition of having migrated there, and were in possession of instruments and household utensils peculiar and original to themselves.

Industrious, dirty, honest, improvident, and lacking in self-control, they became an easy prey to the conquering Russian Cossacks, and soon lost their independence—so much so, that after a very few years they

came to be regarded as a people whose main characteristic was their complete lack of that quality. Hence not much time had elapsed, after the advent of the Russians, before the ravages of disease, drink, and intermarriage had almost exterminated them, and at the present time it is probable that no pure-bred Kamchadale remains.

Eminently sociable, hospitable to a degree, fond of grotesque dancing, polygamists, ignorant of the very elements of law and order, devoid of even a spark of sexual jealousy, their religious and social customs would seem (if we are to trust the writings of the older travellers) to have been primitive in the extreme. Having only a vague notion of a superior Deity, but peopling every volcano, hot spring, and rock with its own attendant spirit, and superstitious enough to offer up prayers to the very beasts which they hunted, they paid implicit attention to the sayings of their Shamans or sorcerers, functionaries resembling the medicine-man of the Red Indian.

Their habitations were not less peculiar than their habits. In summer they lived in the balagan, a beehive-like hut raised on posts to a height of twelve or fifteen feet from the ground. These dwellings were reached by means of a rickety notched pole, and underneath the platform on which the hut rested hung the unsavoury store of fish destined for the winter food of the householder and his family.

In winter several families clubbed together in the common possession of an underground retreat known as a yurt, entered also by means of a notched pole, but in this case downwards through a hole in the roof, which served the double purpose of chimney and entrance.

Quite a different people are the Koriaks, resembling the Kamchadales only in their skin clothes and hospitality—a wandering race of bold reindeer herdsmen, fearless, absolutely independent, jealous, good-natured, but, like children, somewhat easy to offend, and, once offended, revengeful and hard to appease. Wandering from place to place in attendance on their reindeer, they dwell in a peculiar kind of skin tent. Their resemblance to the North American Indians has been remarked by more than one traveller.

Such is a summary of the accounts of the people of Kamchatka as given by the earlier travellers who visited the country, and, as far as my experience goes, it appears to be eminently correct. My own experience of them, having been already given rather fully in another place, need not be repeated here.[32]

Our stay at Karaga did not exceed twenty-four hours; but to those who were interested either in anthropology, geography, or natural history, it was in all senses a profitable and pleasurable one, and our only regret on leaving was that we could not stay a little longer. The sportsmen alone came away dissatisfied, having had very poor sport. A party of them who went inland a little up the course of the river found river-duck as scarce as sea-duck were abundant. Even, however, had the suitable kinds of duck been more numerous, they would probably not have afforded much sport, since most of the year's brood of such species as we saw were either very young or in the flapper stage. The same was true also of the willow-grouse and ptarmigan, of which a few were brought

in. No capercailzie or other game were seen, and the thick growth of scrub and grass must have made the bringing to bag of any big game well-nigh impossible, even had such been obtainable near the village. As a matter of fact, however, bighorn and reindeer probably do not in summer occur nearer than in the mountains, at a distance probably of two or three days' journey from the coast. No doubt in winter, when the snow-storms rage on the higher grounds and the mosquitoes have left the tundras, they are to be obtained nearer the village ; at all events, Dobell states that in the winter of 1812, "Near this village the mountain sheep or argalis are very plentiful; and indeed our good host must have had a large stock, for our party ate mutton every day whilst we were there, and we could not have consumed less than four or five, independently of other food" (pp. 95-6). Bear may, and probably do, occur on the lower ground, but at this time of the year in Kamchatka, food—in the shape of berries and fish—is so abundant, and the vegetation so thick, that to bring one to bag must be a very difficult feat: add to which the fact that even in September the myriads of mosquitoes with which the country is infested make life almost unbearable. So it can be readily imagined that the life of a hunter of big game in Kamchatka is not exactly one of wholly unalloyed pleasure.

The bluejackets had rare sport among the salmon here, easily securing about seventy fish of the species locally known in Kamchatka as the Haiko, *Onchorhynchus lagocephalus* (Pall.). These fish scaled from six to over fourteen pounds, and we estimated the total weight of our catch of seventy fish at at least 600 lbs. The Haiko was, however, not the only fish running at the time, for we obtained from the natives two or three fine examples of another species of the same genus, the Kisutch, *O. sanguinolentus* (Pall.). These two species are the last of the Kamchatkan salmon to ascend the rivers, and were at the time of our visit quite clean, and afforded excellent eating. The flesh is pale, and probably the best flavoured of any of the larger species of the genus with the exception only of the Chervitchi or King Salmon, *O. orientalis* (Pall.).

If salmon were plentiful, hair-seals were, in proportion, almost equally so, of the species *Phoca larga* (Pall.), which in the Pacific takes the place of the common Atlantic Harbour Seal, *P. vitulina* Linn. Of other mammals we saw no trace, and some traps which we set for small species secured nothing. A walrus head, with tusks weighing 15 lbs., was purchased from the natives by one of our party.

Birds of several species were fairly numerous, but our short stay prevented us from making a large collection. But perhaps the most conspicuous bird of all here, as at Petropavlovsk, was a large Diver, *Colymbus sp.*, whose long uncouth body, flying with back slightly bent downwards, rapidly beating pinions, and hoarse croaking cries, was hardly ever out of sight or hearing.

Besides the birds already mentioned, a crow—probably the Kamchatkan form of the Carrion Crow, *Corvus corone levaillanti* Less.—was fairly common, but was not obtained. Close to the village flocks of large and very Long-billed Curlews, *Numenius cyanopus* Vieill., found rich feeding on the berries or at the edge of a small lagoon. Two

species of Gulls, the Red-legged, *Larus ridibundus* Linn., and the Common Gull, *L. canus* Linn., were obtained, and the shooting-party reported that they had found the breeding-place of one species in a marsh up the river. Of small birds, a Yellow and a Pied Wagtail, *Motacilla flava* Linn., and *Motacilla ocularis* Swinh., were also plentiful, and two or three other small species were seen. Wading birds of several kinds were also obtained—*e.g.* the Turnstone, *Arenaria interpres* Linn., the Mongolian Plover, *Aegialitis mongola* Pall., a Stint, *Actodromas ruficollis* Pall., and a Tattler, *Heteractitis brevipes* Vieill.

In addition to birds, a small collection was made of insects, the abundance of which so far north rather astonished some of us. For a botanist, too, a fairly rich field lay open, but we had very little time for noting the vegetation. This was very similar to that of Petropavlovsk, but far poorer in species, though the grass and scrub were every bit as luxuriant. The shrubs and trees consisted of Willows, Alders, dwarfed examples of a Mountain Ash, and of a Pine, *Pinus cembra*, here reduced to a mere shrub. Berry-bearing plants were plentiful, and included the "morushka" and several other kinds. A large pink Willow Herb, *Epilobium*, a large yellow Arnica, the white Arctic Ox-eye Daisy, *Chrysanthemum arcticum*, and a blue Jacob's Ladder, *Polemonium*, were among the more conspicuous flowering plants.

Nothing, perhaps, in these northern moorlands attracts a naturalist's attention more than the exceeding richness of the vegetation, and the comparative abundance of insect life. It might well be supposed that a country which is annually smothered for some nine months out of the twelve beneath a deadening blanket of snow, would have long since had all its life chilled out of it. But this is not so, and even the frozen soil, which never thaws to a depth greater than that of a few inches below the surface, is during the brief summer enlivened by the presence of some of Nature's brightest flower gems, and cheered by the hum of insects busily making the most of the brief allowance of sunshine vouchsafed to them. Summer, in fact, is still summer, even in the north, and while it lasts, such life as there is, is brisk and active as in the south; only the intermediate stages are shortened, and spring and autumn almost crowded out. Thus what is one week snowdrift, white and chilly and lifeless, is the next a bed of brilliant flowers. Red and yellow rhododendra, blue Jacob's-ladder, and monks-hood, and many other species, all await, almost fully developed, the melting of what is in reality a sheltering coverlet of snow, and then suddenly spring out into full bloom and blossom, warmed by the heat of the same sun which has set them free. And this is true, although in a lesser degree, of the most northern tundras which face the Arctic Sea, for right at the extremity of Cape Cheliuskin, the most northerly extension of Asia, twenty-three species of flowering plants and some insects, including flies and even a beetle, were found by the members of Nordenskiöld's[28] *Vega* expedition, and in his crossing of northernmost Greenland Peary[31] "found flowers of numerous varieties blooming in abundance, conspicuous among them the ever-present Arctic poppy." "Two bumble-bees, several butterflies, and innumerable flies were also noted."

At 11 A.M. on August 22nd we started to steam across the twenty-mile channel which separates Karaga harbour on the mainland from False Bay (Guba Lozhnykh Viestei) in Karaginski Island, and anchored in the latter at 4.30 P.M. of the same day. The only excitement of the passage was the sighting of a walrus and her calf, lying on the sandspit which forms the harbour. A boat was lowered to go after them, but (and in looking back I am glad of it) the animals winded us and took to the sea. This was about as commonplace a meeting with a walrus and her calf as one could well imagine. A great shapeless, yellowish-red mass, lying like a huge tree trunk on the sand, without any of the usual accompaniments of ice and cold, it was hard to believe that what we saw was even alive, until the slow movement of the huge head betrayed its nature.

It was a bit of a disappointment to me that I saw no abundance of walrus in this locality, where I had quite expected to see them. The reason for their absence we found out after landing at Karaginski Island, where the presence of a well-built log-hut, looking just as if some enterprising trader had set up a store in this out-of-the-way island, rather astonished us. The natives informed us that the store had been built some twenty or thirty years ago by a party of men landed by an American schooner. These enterprising hunters had built the store to hold the skins and ivory which they took during their stay on the island. According to the account given us by the natives, they "quite cleared the place out of walrus," which explains the fact that we saw only two animals. There must, however, have been a few more about, for the natives had a few tusks for sale. But there are few, if any, parts of Bering's Sea which form a sanctuary for old animals such as to be out of reach of whalers and sealers.

False Bay and harbour are formed by a spit of sand which extends in a south-westerly direction from a point on the western coast of Karaginski Island, rather near its north-western extremity. It is well protected from winds except from south to west. There is no bar, and there is a depth of nine fathoms of water gradually lessening to five at a distance of about two miles from the head of the bay, at which point the water rapidly shoals to one and a half fathoms. The holding-ground is good. The presence of a few scattered balagans at the head of the bay betrayed the existence of another village, and we soon had made acquaintance with a small community, which, while quite as interesting in their dress and habitations as the natives of the mainland, differed from them in the fact that they appeared to be almost or quite pure-blooded.

On August 23rd the weather was again brilliant and warm, and several parties set out in different directions over the island in search, as at Karaga, of sport or natural history specimens. The former were again unfortunate. The reindeer were said to be in the hills at the north of the island, the thick undergrowth effectually prevented the pursuit of bears (if there were any), and, although a good many duck were seen, these were chiefly of non-edible kinds, such as the Scaup, *Fuligula marila* Linn., and the fine King Eider, *Somateria spectabilis* Linn. Some

geese were seen, but were not secured, and the bag consisted mainly of a few couple of willow-grouse. Last, but not least, the native, who, to make assurance doubly sure, had been engaged as guide and shikari, turned out to be not altogether what had been expected of him. In spite of being provided with an ample luncheon, this gentleman's inordinate appetite and love of berries was the cause of many halts and not inconsiderable delay while he filled himself with his favourite food.

The naturalist's party was far more successful. Striking across the undulating country, which rises gradually from the escarpment of the western coast towards the mountains of the eastern side of the island, we found the ground thickly covered with an undergrowth consisting of, as elsewhere in Kamchatka, Mountain Ash, Alder, Willow, and scrubby Pine (*Pinus cembra pumila*, Pall.). The latter, the "Kedrevnik" of the Russians, the "trailing pine" of Kennan (pp. 267-8), the "trailing cedar" of the English translation of Wrangell, is "found on the most desolate steppes and upon the rockiest mountain-sides from the Okhotsk Sea to the Arctic Ocean," furnishes almost the only firewood of the Koriaks and Chukchis, and is the boon of the traveller in NE. Siberia.

The pine-thickets were especially dense, and we fully appreciated Guillemard's difficulty in getting through them at Cape Shipunski (vol. i. p. 212). Between the thickets were small glades thickly covered with grass and several species of flowering plants, and forming the only means of passage over the country. In the undergrowth any number of bears or of other game might have easily lain hid, secure from all disturbance, and the solitary willow grouse which we surprised and shot must be regarded as a very lucky addition to the bag. In the thickets we were surprised to find several birds of small species rather plentiful, but the fact that we had come nearly to the end of our stock of cartridges did not improve our chances of procuring specimens in such a country. With a twelve-bore shot-gun and sporting cartridges charged with large shot, our only weapon, and the quarry a set of little birds sitting at provokingly close quarters in thick bushes, the result of a shot was often more disastrous to the poor birds than advantageous to our collection, and on more than one occasion we were strongly tempted to follow the example of our friends the natives—to lie down and eat berries. Still, it was near the end of our cruise, and no other cartridges were available, so we had to do our best, and succeeded in obtaining more or less mutilated examples of several species of small birds, for all of which the locality proved an extension of their known range, while one of them, *Accentor montanellus* (Pall.), is an addition to the Kamchatkan avifauna.

Besides the trees and shrubs already mentioned, we noted many plants with which we were already familiar on Bering's and Copper Island, such as some Umbellifers, a red Star Thistle, a conspicuous Geranium, a large pink Willow Herb (*Epilobium*), a blue Iris (*Iris? sibirica*), a Polemonium, Golden Rod, Rhododendron, Nettle, Tansy, Equisetum, and many berry-bearing plants, including *Conus*, *Empetrum*, and plants bearing the berries known locally as the "morushka" and the "hurtz."

Among the wealth of attractive flowers two species of humble-bee

were busily engaged in reaping an abundant harvest, and we saw also three species of Butterflies—a tortoise-shell (*Vanessa*), a garden White (*Pieris*), and a yellow species—two bronze Dragonflies, and several species of flies, beetles, and spiders, of which a small collection was brought home, but has not yet been worked out.

Under the hot afternoon sun, the mosquitoes became so troublesome that we were glad to go on board ship somewhat earlier than had been intended, and on the following day, the 24th August, at 6 A.M., we weighed anchor and sailed for Petropavlovsk, regretting that our meeting with such a quaint and simple-minded people and an almost unknown country should have been such a short one.

The voyage lasted a little over three days, and our arrival at Petropavlovsk at about noon on August 27th has been described above. The journey was uneventful, but disappointing, as during the whole time the weather was never clear enough to enable us to get a good view of the coast, of which in clear weather we might have enjoyed a view probably never to be enjoyed again. The time was occupied in skinning the birds obtained in Ukinsk Bay, and the monotony of our misty way was only occasionally varied, as by the arrival of a Turnstone on board the ship on the evening of the 25th, and by a glimpse of the barque *Bering* on the dirty evening of the 26th. The *Bering*, the property of the Russian Fur Seal Company, was lying-to, unable to make much progress, and we pitied her sadly as we left her behind. However, she reached Petropavlovsk safely before we left, and we had an opportunity of saying good-bye to her weather-beaten skipper, an Englishman, whose long experiences in navigating a large sailing-ship in Bering's Sea have been as unenviable as they are creditable to his skill as a seaman.

Early on August 31st we said our last good-bye to our good friends at Petropavlovsk, and sailing at 9 A.M. with a calm sea, and practically no wind, we had our last look at Kamchatka on this day. A dull morning cleared up into a beautiful fine day, with bright sun and calm blue sea, yet the clouds and fog never released their grip of the higher mountains, and only allowed us to see the fine cliffs at their base and the lesser hills. From about 4 P.M., although still ourselves in the bright sunshine, we could see a belt of fog closing in upon us in a semi-circle ahead and to the east. This fog-bank lay only on the surface of the sea, and did not extend upwards to a height of more than fifty feet above the waves, so that when we ran into it at about 5 P.M., although ourselves enveloped in thick mist which prevented us from seeing ahead or horizontally on any side of the ship, the bright sun and blue sky above our heads were not obscured from view. The fog was, fortunately for our comfort, not a thick one, and later in the day we passed out of it, and were not troubled much with thick weather during the remainder of our voyage to Hakodate.

During the course of this article I have, I believe, alluded to all the larger or more important works which deal with Kamchatka generally. For the sake of completeness I now give a list of these, together with the titles of other works referred to, and of some papers on matters

Kamchatkan which have appeared in various journals, and which are either not the work of writers who have themselves visited the country, or which deal with some special point connected with it, such as agriculture, fish, or people. For many of these I am indebted to the kindness of Dr. H. R. Mill, librarian of the Royal Geographical Society. Considerable trouble has been taken to make the list as complete as possible, but it can hardly be hoped that it is absolutely so for all languages, although it probably is for works and articles written in English.

Bibliography.

"Geschichte von Kamtschatka. Von dem Lande. Von den Einwohnern. Politische und bürgerliche Geschichte. Von den nahe bey Kamtschatka liegenden Länder und Völkern." (*Algemeine Historie der Reisen*, vol. xx. book vii.)

Castell, P. "Abhandlung über die berühmten Länder Kamtschatka und Jesso, oder über die Gemeinschaft des festen Landes von Asien und America und die Durchfahrt aus dem Oestlichen in das Nördliche Meer." (*Algemeine Historie der Reisen*, vol. xx. book vii.)

[1] Krasheninnikoff, S. P. *The History of Kamtschatka and the Kurilsky Islands, with the countries adjacent.* Translated into English from the Russian by James Grieve. (1764).

[2] Steller, G. W. *Beschreibung von dem Lande Kamtschatka*, etc. (Frankfort, 1774.)

[3] King, Capt. James. *A Voyage to the Pacific Ocean performed under the Direction of Captains Cook, Clerke, and Gore.* Vol. iii. (London, 1785.)

[4] Lesseps, J. B. B. de. *Journal Historique du Voyage de M. de Lesseps, Consul de France*, employé dans l'expédition de M. le comte de la Pérouse, en qualité d'interprète du Roi; depuis l'instant où il a quitté les frégates Françoises au port Saint-Pierre et Saint-Paul du Kamtschatka, jusqu'à son arrivée en France, le 17 octobre 1788 (1790): also English translation of the same (1790).

[5] La Pérouse, J. F. G. de. *Voyage de La Pérouse autour du Monde*, publié conformément au Décret du 22 Avril, 1791, et rédigé par M. L. A. Milet-Mureau, Général de Brigade, etc. (1799).

[6] Sauer, Martin. *An Account of a Geographical and Astronomical Expedition to the Northern parts of Russia, for ascertaining the degrees of Latitude and Longitude of the mouth of the river Kolima; of the coast of the Tshutski, to East Cape; and of the Islands in the Eastern Ocean, stretching to the American coast.* (1802.)

[7] Sarychef, Capt. *Voyages along the N.E. coast of Siberia, and Arctic and Pacific Oceans, during eight years with the Geographical and Astronomical Expedition, under the command of Captain Billings from* 1785 *to* 1793. (1802.)

[8] Coxe, W. *Account of the Russian Discoveries between Asia and America, to which are added the Conquest of Siberia, and the History of the Transactions and Commerce between Russia and China.* (1st edition, 1780: 4th edition, 1804.)

[9] Krusenstern, A. T. *Voyage round the World in the years* 1803, 1804, 1805, *and* 1806, *by order of his Imperial Majesty Alexander the First, on board the ships Nadeshda and Neva, under the command of Captain A. T. Von Krusenstern, of the Imperial Navy.* Translation from the original German by Richard Belgrave Hoppner. (1813.)

[10] Langsdorff, G. H. von. *Voyages and Travels in various parts of the World, during* 1803, 1804, 1805, 1806 *and* 1807. (1814.)

[11] Kotzebue, Otto von. *A Voyage of Discovery into the South Sea and Bering's Straits for the purpose of exploring a North-East Passage.* (Translation by H. E. Lloyd, 1821.)

[12] Golovnin, Capt. W. *Memoirs of a Captivity in Japan during the years* 1811, 1812, *and* 1813, etc. (2nd edition, 1824, vol. i. p. 1). I have not been able to find Captain Golovnin's account of his Kamchatkan explorations, to which he alludes in this work.

[13] Cochrane, Capt. J. D. *Narrative of a pedestrian journey through Russia and Siberian Tartary, from the Frontiers of China to the Frozen Sea and Kamtchatka.* (4th ed., 1825.)

[14] Dobell, Peter. *Travels in Kamchatka and Siberia; with a narrative of a Residence in China.* (1830.)

[15] Beechey, Capt. F. W. *Narrative of a Voyage to the Pacific and Bering's Strait, to co-operate with the Polar Expeditions: performed by His Majesty's Ship Blossom.* (1831.)

Postels, A. "Bemerkungen ueber die Vulkane der Halbinsel Kamtschatka, gesammelt

auf einer Reise um die Welt in den Jahren 1826. bis 1829, auf der Brigg Senjarin." (*Mem. Acad. Soc.*, St. Petersburg. Ser. vi. 1835; ii. (11-28). 7 plates.)

Erman, A. "Ortsbestimmungen bei einer Ueberfahrt von Ochozk nach Kamtschatka und darauf begründete Untersuchung der Strömungen im Ochozker oder Penjinsker Meere." (*Berghaus' Annalen*, Berlin, 1838. Ser. iii.-v. 387-410. Tables.)

"Kamschatka, Note on a new Map of." Extract from a letter from Professor Adolph Erman. (*J. R. G. Soc.*, ix., 1839, 508-11.)

[16] Müller, G. F. *Conquest of Siberia, and the History of the Transactions, Wars, Commerce, etc. etc., carried on between Russia and China, from the earliest Period.* Translated from the Russian of G. F. Müller, historiographer of Russia, and of Peter Simon Pallas, M.D., F.R.S., etc. (1842.)

Erman, A. "Ueber Ebbe und Fluth an den Ochozker und Kamtschatischen Küsten des Grossen Oceans." (Erman's *Russ. Archiv.*, Berlin, 1843; iii. 634-682.)

Erman, A. Ueber zwei auf Kamtschatka und bei Ochozk gefundene Antiquitäten. (Erman's *Russ. Archiv.*, Berlin, 1844; iv. 399-406. Plate.)

[17] Erman, A. *Reise um die Erde durch Nord-Asien und die beiden Oceane in den Jahren*, 1828, 1829, *und* 1830. (Berlin: 1848.)

Diener, Dr. Carl. "Ergebnisse der Forschungsreisen K. v. Ditmars auf der Halbinsel Kamtschatka in den Jahren 1851-55." (*Peterm. Mittheil.*, 1891; xxxvii. 175-182.)

Selsky, I. V. "Information on La Pérouse's arrival in Kamtchatka." [In Russian.] (*Vestnik I. R. G. Soc.*, St. Petersburg, 1852; vi. pt. 6, 6-18.)

Sokoleff, A. P. "Sketch of Kamtchatka coast." [In Russian.] (*Izvestiya I. R. G. Soc.*, St. Petersburg, 1852; v. pt. 2, 11-19.)

Hult, L. Sketch of Kamchatka. (*Geogr. Förh. Tidsk.*, Helsingfors, 1891; iii. 113-119.)

Bulysheff, I. D. "Agricultural experiments in Kamschatka. (*Vestnik I. R. G. Soc.*, St. Petersburg, 1853. [In Russian.] viii. pt. 2, 75-88.)

Ditmar, Karl von. "Information on the Koryak and Chukchi tribes, inhabiting the shores of Kamchatka. [In Russian.] (*Vestnik I. R. G. Soc.*, St. Petersburg, 1856; xv. pt. 5, 51-63; xvi. pt. 5, 19-39.)

[18] Habersham, Lieut. A. W. *My Last Cruise, or where we went and what we saw: being an account of visits to the Malay and Loo-choo Islands, the coasts of China, Formosa, Japan, Kamtschatka, Siberia, and the Mouth of the Amoor River.* (1857.)

[19] Kittlitz, F. H. von. *Denkwürdigkeiten einer Reise nach dem russischen Amerika, nach Mikronesien und durch Kamtschatka.* (Gotha: 1858.)

[20] Tronson, J. M. *Narrative of a voyage to Japan, Kamtschatka, Siberian Tartary, and various parts of the coast of China in H.M.S. Barracouta.* (1859.)

[21] Collins, P. M. *A Voyage down the Amoor: with a Land Journey through Siberia and incidental Notices of Manchooria, Kamschatka, and Japan.* (1860.)

Beaumont, H. "Essais d'Agriculture dans le Kamtchatka." (*Mém. Soc. Géogr.*, Geneva, vol. i., 1860, 117-131.)

Ditmar, Karl von. "Die Vulcane und heissen Quellen Kamtschatkas." (*Petermann's Mitteilungen*, 1860, pp. 66-67.)

[22] Whymper, Fred. *Travel and Adventure in the Territory of Alaska.* (1868.)

Kennan, George. *Tent-Life in Siberia, and Adventures among the Koraks and other Tribes in Kamtschatka and Northern Asia.* (1870.)

[23] Kennan, George. "A Dog-Sledge Journey in Kamtschatka and North-eastern Siberia." (*Journ. Amer. Geogr. Soc.*, New York, 1876-8, 96-130.)

[24] Bush, R. J. *Reindeer, Dogs, and Snow-shoes: a Journal of Siberian Travel and Explorations made in* 1865, 1866, *and* 1867, etc. (London and New York: 1871.)

[25] "Geological Notes on some of the Coasts and Islands of Bering's Sea and Vicinity." (*Bull. Geol. Soc. America*, vol. 5, pp. 117-146, Feb. 2, 1884.)

Dawson, Dr. G. M. "Note sur le Kamchatka. (Extrait de l'Alaska Herald)." (*Bull. Soc. Géogr.*, Paris, 1872-6; s. iv. 175-6.)

"Kamtschatka, seine natürlichen Reichthümer und Gewerbe." (*Russ Rev.*, 1884, 24, 248-252: 357-362.)

[26] Stejneger, Dr. L. "Results of Ornithological Explorations in the Commander Islands and in Kamtschatka." (*Bull. U.S. Nat. Mus.*, No. 29 (p. 343), 1885.)

Schmidt, Prof. Dr. Carl. *Hydrologische Untersuchungen* xliv. "Die Thermalwässer Kamtschatkas." Map. St. Petersburg: 1885. (*Mem. Acad. Soc.*, St. Petersburg, 1885. Ser. vii. 32, No. 18, 1-29. Map.)

[27] Guillemard, F. H. H. *The Cruise of the "Marchesa" to Kamschatka and New Guinea, etc.* (1st edition, 1886.)

"Die Thermen in Kamtschatka." (*Zeitschrift. Gesell. Erdk.*, Berlin, 1886, 21, 385-386.)

[28] Nordenskiold, A. E. *The Voyage of the Vega round Asia and Europe.* Translation by Alexander Leslie. (London, 1888, pp. 342-3.)

"Kamtschatka, das Land der Lachse." (*Das Ausland*, Stuttgart, 1888, 61, 625-629.)

[29] Ditmar, K. von. *Reisen und Aufenthalt in Kamtschatka, in den Jahren* 1851 *bis* 1855. First part, with 2 maps and 32 woodcuts. (St. Petersburg, 1890.)

Obrucheff, V. A. "Charles Ditmar's sketch of Kamchatka." (*Izvest. East. Sib. Sect. I. R. G. Soc.* [In Russian.] Irkutsk, 1892, 23, or 4 and 5, 1-22. Map.)

Brückner, A. "Kamtschatka." (*Ausland*, 66, 1893 : pp. 63, 664, 682, 699.)

[30] Ratzel, F. *The History of Mankind.* Translated from the second German edition by J. Butler, M.A. 3 vols. (1896-98.)

[31] Peary, Lieut. E. A., U.S.N. "Journeys in North Greenland." (*The Geographical Journal*, March 1898, p. 225.)

[32] G. E. H. Barrett-Hamilton and H. O. Jones. "A Visit to Karaginsky Island, Kamchatka." (*Geogr. Journ.*, London, Sept. 1898, pp. 280-299.)

ANTARCTIC EXPEDITION.

In October of last year this *Magazine* issued a Special Antarctic Number, in which the scientific advantages of an Antarctic expedition were fully set forth by Sir John Murray and others. It was pointed out that to do the work creditably, £100,000 at least would be required. An appeal made to its members by the Royal Geographical Society of London was responded to by subscriptions amounting to some £13,000 only, including, however, two handsome subscriptions of £5000 each. With this inadequate sum it was hopeless to think of fitting out an expedition from this country, and it seemed probable that the glory of exploring the greatest unknown area on the globe would be left to Germany alone. Fortunately, Mr. Llewellyn Longstaff's munificent gift of £25,000 made it possible for the President of the London Society to return a favourable reply to the inquiry in Baron von Richthofen's letter as to whether England would be prepared to join with Germany in 1901 [1] in attacking the many unsolved problems of the Antarctic regions. The sum available (about £40,000) is, however, far short of what is necessary to provide a properly equipped expedition. It may suffice to fit out one ship in a modest way, but two ships, at least, are required—adequately supplied with material and men, including, of course, a trained scientific staff. Here, then, is an opportunity for patriotic Scotsmen! In Germany, every one, from the Emperor downwards, will do what can be done to make their expedition complete and a credit to the fatherland. We cannot afford to do less, and it is to be hoped that some wealthy Scotsman or Scotsmen will come forward to emulate the munificence of Mr. Longstaff, so that the expedition which leaves our shores next year may be one in every way worthy of a country which has so great a reputation to maintain.

James Geikie.

[1] The German expedition is postponed to 1901, and the British expedition will in all probability set out the same year, if the necessary funds (not less than £80,000) are obtained.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Lecture delivered in April.

On April 6th Mr. Albert B. Lloyd described in the Queen Street Hall, Edinburgh, his journey "From the Mountains of the Moon to the Congo." Professor G. W. Prothero presided at the meeting.

Lectures in May.

Mr. J. A. T. Ross Cormack will deliver an address entitled "Five Years in South-eastern Africa," in the Society's Hall, Edinburgh on May 4th.

Probably Mr. J. Y. Simpson will deliver in Edinburgh the lecture he was unable to give in February, some time during the month.

Colonel Bailey will address the Aberdeen Branch on May 11th. His subject will be "Across Canada from the Atlantic to the Pacific."

GEOGRAPHICAL NOTES.

By The Acting Editor.

EUROPE.

The Ordnance Survey Datum Level.—Heights on the Ordnance Survey maps are measured from the assumed level of the mean tide at Liverpool as fixed by observations in 1844, which differs slightly from the mean sea-level as since determined by the self-registering tide-gauge at that port. In 1859, a network of levelled lines having been carried across England and round the coast, Sir Henry James, then Director-General, ordered the mean sea-level to be observed at nineteen coast stations in England and Wales. Graduated gauges were set up in suitable positions and the height of the water was recorded every ten minutes on the gauge, of which the zero had been referred to the nearest bench-mark. The observations covered a complete tide, or twelve hours daily, and were continued on the average over sixteen and a half tides, 20,000 to 25,000 observations in all being taken at the nineteen stations. Data as to the mean sea-level at thirteen other stations were also obtained from other sources. The result, omitting those stations in the estuary of the Thames where abnormally high levels were observed, showed that the mean level of the sea round the coast was ·630 foot or 7⅝ inches higher than the datum at Liverpool.

In 1896, a revision of the large-scale maps of England and Wales having been commenced, Colonel Farquharson considered it advisable that tidal observations should be repeated in order to ascertain whether those carried out in 1859 were still approximately correct, and directed Captain H. S. King, R.E., to superintend the work. The same method was employed as on the former occasion, and the records indicate that the mean level of the sea at twenty-two stations is ·517 foot or 6⅛ inches above the Ordnance Survey datum. Although there are considerable differences at individual stations, such as nearly a foot at Silloth, the mean difference of the observations of 1859 and 1896 is only 1⅝ inches, and the agreement of the two series is so close as to indicate that there has been practically no change in the mean sea-level round the coasts of England and Wales during the

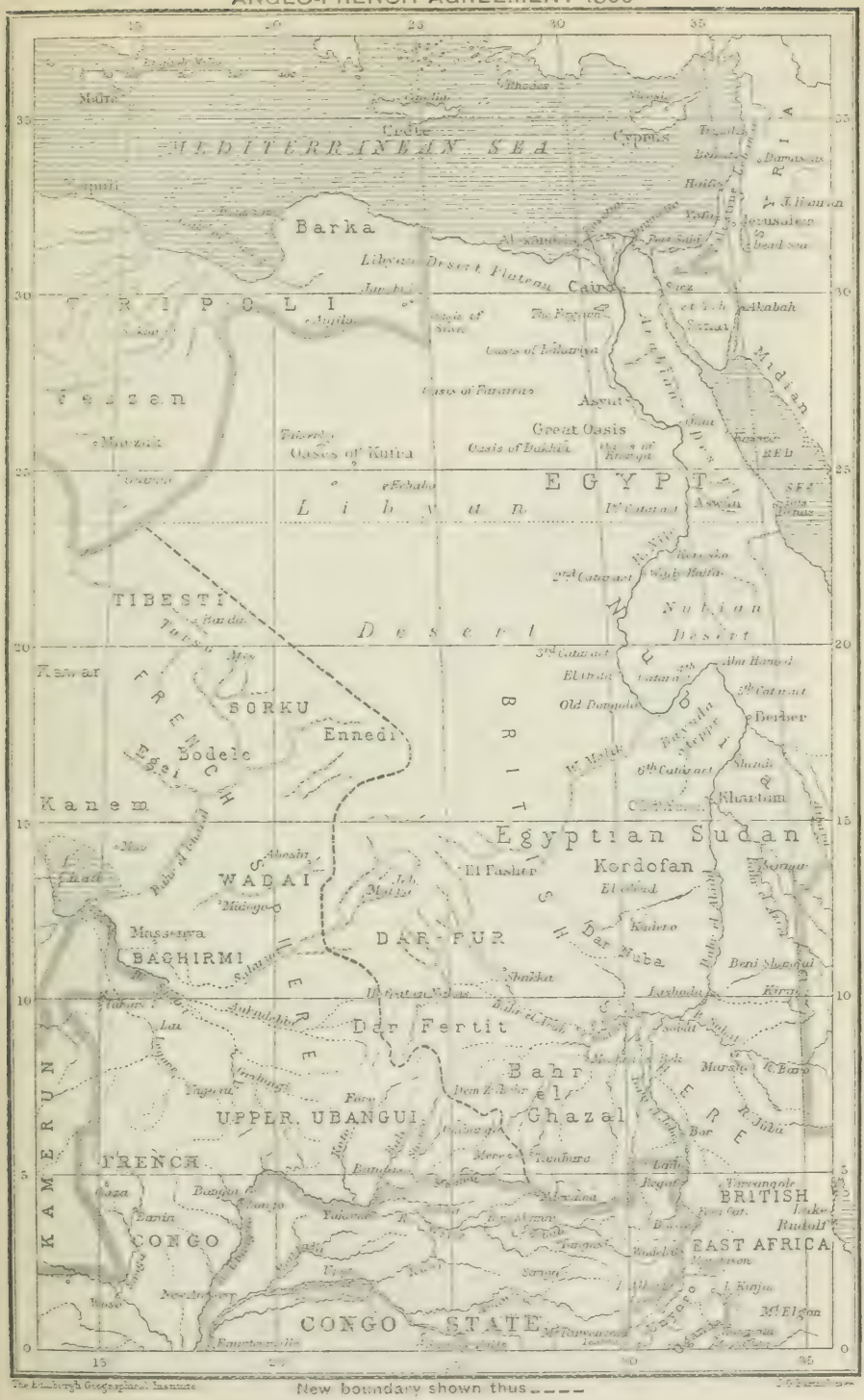
last forty years. The level at the eastern stations was found to be 6½ inches higher than at the western in 1859, and 5½ inches higher in 1896. That this is due to errors in levelling across the country from Liverpool to the east coast seems inadmissible, since Sir Charles Wilson caused the main line from Liverpool to Spurn Head to be twice carefully re-levelled, when no material change could be made in the levels taken fifty years earlier. These observations support the accuracy of the main lines of the spirit-levelling of the Ordnance Survey, and Colonel Farquharson remarks in his report that "the present generation should be grateful to its early superintendents, such as Generals Colby and Sir Henry James, Colonel Alexander Clarke and other officers, who placed the work on a basis of scientific accuracy then unknown in other countries, and which has enabled their successors to carry out the details of the survey with comparatively little difficulty."

The School of Geography at Oxford.—About twelve years ago the Royal Geographical Society established Readerships in Geography at Oxford and Cambridge. At Oxford the movement met with so much encouragement that at the end of ten years the University undertook to provide for the continuance of the work without further assistance from the Society. Hitherto Mr. Mackinder has performed the ordinary duties of a Reader, giving a certain number of lectures each term, but it is now felt that something more is required, and by the end of the year a geographical institute will be established under Mr. Mackinder's superintendence. The Royal Geographical Society has offered £400 a year for five years, on the condition that the University subscribes an equal sum, and there is every reason to expect that Congregation will sanction the grant. The Reader will lecture twice a week on topographical and historical geography, while his assistant will share with a lecturer the field of physical geography, and will teach surveying and cartography. A second lecturer will hold a weekly class on ancient geography. The upper floor of the Ashmolean Museum will be fitted up for the purposes of the school, and part of the annual income will be devoted to the purchase of books, maps, and geographical appliances. At least one scholarship of £60 will be attached to the school.

AFRICA.

The New Boundary between the Egyptian Sudan and the French Central African Territory.—By the agreement negotiated in March, the frontier is to run from the boundary of the Sudan and the Congo State, probably a little south of the fifth parallel of north latitude, along the watershed of the Bahr-el-Ghazal to the eleventh parallel. From the eleventh to the fifteenth parallel it will follow the boundary between Darfur and Wadai, wherever that may prove to lie, nowhere, however, passing to the west of long. 21° E., or east of long. 23°. The most northern point fixed is the intersection of the Tropic of Cancer with the sixteenth meridian of E. long., near the southern frontier of Tripoli, and from this point the dividing line will run south-eastwards to the twenty-fourth meridian, which it will follow southwards to the northern frontier of Darfur. In the south this frontier will be delimited without great difficulty, though the watershed of the Bahr-el-Ghazal is not everywhere very conspicuous, but it may not prove so easy to discover exactly where the boundary between Darfur and Wadai lies. Very little is known of the latter country, which is reputed to be one of the strongest of Central African States. Several travellers have made attempts to penetrate into it; Vogel stayed in the capital, Abeshr, but was murdered by the Musulmans, and Nachtigal alone brought back information about the central part of the country. The highlands

ANGLO-FRENCH AGREEMENT 1899



New boundary shown thus - - - -

Scottish Geographical Magazine 1899

of Tibesti also are known in part through the journey of the same traveller along their northern skirts in 1869. The more elevated mass which he descried towards the south he estimated at more than 8000 feet. Much of the country now acquired by the French between Lake Chad and the Egyptian frontier has therefore still to be explored, and it will be long ere French authority can be extended over tribes formidable in numbers and courage, and so far removed from the coast.

It is provided that delimitation shall be executed as far north as the fifteenth parallel. Beyond this point, then, the boundary will remain very indefinite, but it is understood that the French territory is to include the highlands of Tibesti and Borku.

A clause in the convention guarantees that the subjects of both Powers shall enjoy equal trading rights between the parallels of 5° and 14° 20′ N. lat. A similar stipulation was included, it may be remembered, in the Niger convention of last year.

Egypt and the Sudan in 1898.—Lord Cromer's report contains much that is interesting from the point of view of commercial geography. He deals first with the Sudan, the revenue from which amounted to £E.35,000, while the expenditure was £E.235,000 (an Egyptian pound = £1. 0s. 6d.). The cost of the Sudan campaigns since 1896, including the railway to Khartum, has been £E.2,354,354. It is estimated that during the present year the revenue will be £E.51,500, and the expenditure £E.383,272, leaving a deficit of about £E.332,000. For the present the Sudan has been divided into six provinces, namely, Dongola, Berber, Kassala, Sennar, Fashoda, and Khartum. Suakin will be under a separate governor.

Almost immediately after the battle of Omdurman, a sum of £E.300,000 was set apart for extension of the railway from the Atbara to Khartum, a distance of 187 miles, and by February 13th, 50 miles of bank had been made, and 15 miles of rail laid. A temporary wooden bridge has been thrown across the Atbara, but it is anticipated that the superstructure of a permanent bridge will arrive about the middle of May. An English firm offered to deliver the work in six and a half months, at a cost of £10,490, whereas an American firm tendered a price of £6500 for delivery in forty-two days. The latter offer was naturally accepted.

As there is water communication between Khartum and Fashoda throughout the year, railway construction in this direction is not urgent. More pressing is communication between the Nile Valley and the Red Sea. The route from Suakin to Berber has never been properly surveyed, but it passes through a long stretch of almost waterless desert, and Lord Cromer is inclined to give the preference to the route *viâ* Abu Haras, Gedaref, and Kassala, passing through lands called by Sir S. Baker "the granary of the Sudan." A short time ago, when almost famine prices ruled at Omdurman, grain was well-nigh unsaleable at Gedaref. In February the price was £1, 12s. 6d. per ardeb (300 lbs.) and only 4s. 6d. at Gedaref. It will therefore be desirable, as soon as the railway reaches Khartum, to make arrangements for its extension to Abu Haras, a distance of 122 miles. No engineering difficulties are expected, but it may not be so easy to provide the cost in the present condition of the finances. The telegraph system will be extended up the east bank of the Blue Nile to Abu Haras. Thence a branch line will be carried to Gedaref, and will be connected with Kassala. A second line will run from Abu Haras to Sennar, and thence to Aba island in the White Nile, and up the river to Fashoda and the Sobat.

At present only a small fringe of land beside the river is cultivated, and a considerable outlay of capital on canals would be necessary to increase the cultivable area to any extent. Sir William Garstin, who has gone up the Nile, may be

able to throw some light on the question. The want of population is another serious difficulty. The country between the Atbara and Khartum, which is inhabited by the Jaalin tribe, has been almost depopulated, and Metemmeh, formerly a large town and one of the trade centres of the Sudan, now contains only 160 men and over 1000 women.

Exploration above the confluence of the Sobat has been much impeded by sudd. Last September a gunboat was sent up the Bahr-el-Ghazal nearly to Meshra-er-Rek, but six months later the river was found to be blocked 15 miles north of the junction of the Bahr-el-Arab. The Bahr-el-Jebel was blocked almost down to its mouth, but a reconnaissance up the Bahr-es-Zeraf was more successful, the gunboats forcing their way for 195 miles, to about lat. 7° 35′ S., only 8 to 10 miles from the Bahr-el-Jebel. Navigation afterwards became more difficult, owing to the fall of the water. The Sobat proved to be a good navigable stream. The junction of the Adura (lower course of the Baro), and the Juba (locally known as the Pibor), 212 miles from the mouth was reached, and the former tributary was explored for 30 miles, and the Pibor to the end of navigation (75 miles). The width of the Sobat is 150 to 200 yards, and its depth over 20 feet.

The estimates of the Egyptian revenue and expenditure for 1898 showed equilibrium, while the actual result was a surplus of £E.484,000, due to an increase of revenue under all the principal heads. British capital is now beginning to flow into the country, and among several other proposals to the Government there have been some to establish cotton manufactories. The proposals hitherto made, however, involve the encouragement of a protected cotton industry, which would be detrimental both to British and Egyptian interests.

Passenger traffic on the railways continues steadily to increase. Early in 1898 the line from Nag-Hamadi to Keneh (34 miles), was opened, and the Keneh-Aswân section was also finished. The break of the gauge at Luxor is to be regretted. The line from Shirbin to Kafr-es-Sheikh was nearly finished at the end of the year, only two small bridges and two miles of railway remaining to be constructed.

The summer supply of water from the Nile was below the average, while the flood was decidedly high. The low summer supply caused a certain quantity of rice to be lost, but the cotton crop was saved. Such seasons do not occur more than once in five years, and it is hoped that the reservoir will be completed before another occurs.

Sir William Garstin gives the following details about the Nile reservoir :—

"The dam which is to form the reservoir will be built at the first cataract, a few miles south of Assouan. It is designed to hold up the water to a level of 106 mètres above mean sea-level, or rather more than 20 mètres (65 feet) above the low-water level of the Nile at site. Its total length will be 2156 yards, with a width at crest of 26·4 feet. The width of base at the deepest portion will be 82·5 feet, and the height of the work at the deepest spot will be 92·4 feet. The dam will be pierced by 180 openings or under-sluices (140 of which are 23·1 feet by 6·6 feet, and 40 are 182 feet by 6·6 feet), provided with gates. These sluices will pass the flood and surplus water through the dam, and by them the reservoir will be emptied when water is required for irrigation in Middle and Lower Egypt. Three locks will be built, and a navigation channel made on the west of the river, to enable boats to pass up and down.

"The dam at Assiout will be what is called an open Barrage, and will be similar in construction to the existing Barrages on the Rosetta and Damietta branches. The new work will consist of 111 bays or openings, each 16·5 feet wide, and each bay will be provided with regulating gates. The total length of the work will be

903 yards. A lock 53 feet in width will be constructed on the west bank, large enough to pass the largest tourist boat plying on the river. By regulating on this Barrage water will be supplied in spring and summer to the Ibrahimieh Canal, which irrigates Middle Egypt."

In spite of difficulties of transport consequent on the Sudan campaign, a considerable amount of work has been done, a large quantity of rock excavation was executed in 1898, and now the masonry has been commenced.

AMERICA.

The Sources of the Saskatchewan and Athabasca.—In the summer of 1896 Mr. Walter D. Wilcox travelled up the Bow river to the Upper Bow lake, 4 miles long, and crossed the pass, 6700 feet high, to valley of the Little Fork of the Saskatchewan. Descending this tributary, he came to the main river, and then followed the North Fork, as he named it, which joins the river a mile above the Little Fork, passing a considerable tributary running in from the west, and found a pass 8000 feet high into the valley of the Athabasca. Subsequently, in 1898, he made a second journey, on this occasion following the Middle Fork of the Saskatchewan, passed Mt. Forbes, and crossing the Howse, Howes, or Hawes pass, descended into the Blaeberry valley, and by another pass to the south-east reached the north branch of the Kicking Horse river. His narrative is published in the *Geographical Journal*, and in the *Nat. Geog. Magazine*, for April.

Other important expeditions were made in 1897 and 1898 by Professor Norman Collie, of which he gave an account to the Royal Geographical Society, published also in the April number. The main object of the expeditions was mountaineering, but finding the country very imperfectly delineated on maps, Professor Collie did a large amount of exploration. In particular his attention was turned to the mountains Brown and Hooker, reported by the expedition of Captain Palliser, 1857-1860, as 16,000 and 15,000 feet high respectively. In 1893 Professor Coleman, of Toronto, went out to search for them, and found the Committee's Punchbowl, with peaks on either side only about 8000 and 11,000 feet high respectively (see *S.G.M.*, vol. xi. p. 82).

In the first summer Professor Collie, accompanied by Mr. G. P. Baker and P. Sarbach, a Swiss guide, travelled down the Little Fork, and ascended Mt. Sarbach, 11,100 feet high, the most northern point of the Waputehk range. Here Glacier lake was visible, and away to the north-west two lofty peaks, probably the Mt. Lyell of Dr. Hector. Then the party travelled up the Middle Fork, and attempted to ascend Mt. Freshfield, about 12,000, but did not reach a height of more than 10,000. A very lofty mountain, probably 14,000 to 15,000 feet, was seen 30 miles away in a north-westerly direction, and as only two peaks, Mt. Brown and Mt. Hooker are marked on maps to the north of Mt. Lyell, it was supposed that this was one of them. Howse pass was then crossed, and the pass mentioned above between the Blaeberry and the North Fork of the Kicking Horse river, which was found to be 6800 feet high, and was named after Mr. Baker.

The following year, 1898, Professor Collie, with Messrs. H. Woolley and H. E. M. Stutfield, made for the Saskatchewan by the Pipestone pass (8400 feet) and the Siffleur valley, in order to investigate Mt. Murchison, which Dr. Hector states is visible from the pass. Two peaks were visible between the Lower Bear Creek (Little Fork of the Saskatchewan) and the main river. This mountain had been seen from Mt. Sarbach, and cannot be much over 12,000 feet in height. Then, ascending with considerable difficulty the North Fork, the party camped on Wilcox pass, and Professor Collie and Mr. Woolley climbed a peak to the south-west,

which they named Mt. Athabasca (11,900 feet), where they had a fine view over mountains and glaciers. To the south-west Mt. Bryce, as they named it, after the Right Hon. James Bryce, President of Alpine Club, rose to nearly 14,000 feet. Next they ascended the Athabasca glacier, at the foot of the mountain, to a huge icefield extending to Mt. Columbia, north of which rose the Twins, and still farther stood Mt. Alberta, which Professor Collie, on seeing it from Mt. Athabasca, thought might be Mt. Brown.

Having crossed the pass to the Athabasca river, Professor Collie searched for a pass to the westwards, hoping thus to reach the western branch of the river. He soon found that no such pass existed, so after camping out on the Diadem glacier, and ascending the Diadem peak (11,500 feet), a few miles north of Mt. Alberta, which is more than 2000 feet higher, he and his friends returned down the North Fork and along the Bear Creek.

On returning to England, Professor Collie found the journal of David Douglas, the naturalist, in the *Companion to the Botanical Magazine*, and from the account there given he comes to the conclusion that there is only the one Athabasca pass, and that Professor Coleman was correct in his identification of Mount Brown and Mount Hooker. Douglas could not have climbed Mt. Brown in an afternoon, as he states, if it were 16,000 or 17,000 feet high. The mountains to the south explored by Professor Collie and his party, grouped round the glaciers that feed the Athabasca, Saskatchewan, and Columbia, the three largest rivers in Canada, are probably the highest part of the Canadian Rockies.

The Mackenzie River.—M. Éd. de Sainville travelled in 1891 to 1894 in the north of the Dominion. Leaving the Canadian Pacific Railway at Calgary, he passed through Edmonton to Athabasca Landing and Fort M'Murray. A flat-bottomed steamer, the *Athabasca*, was put on the river in 1888, and plies between Lesser Slave lake and the Great Rapids above Fort M'Murray, 87 miles from Athabasca Landing, where the river falls 60 feet in two miles. Fort Chippewyan, 185 miles farther on Lake Athabasca, is the capital of the Athabasca district. The lake is 120 miles long by 40 broad at its widest part. The *Graham*, a flat-bottomed steamer, plies between Fort M'Murray and Smith Landing on the Slave river and ascends the Peace to the lowest rapids. Smith Landing, 87 miles from Fort Chippewyan, stands at the head of a series of rapids, and is connected by a primitive road 15 miles long with Fort Smith, along which the goods brought by the steamer are forwarded on ox-carts. Below this to the sea there is uninterrupted navigation, and the screw-steamer *Wrigley* distributes goods as far as Peel river. The Great Slave lake is quite an inland sea, with deep water often troubled by dangerous storms. At the mouth of the Slave river and the outlet of the Mackenzie the water is not more than 7 feet deep. The passage across the lake is 140 miles in length, and the current of the Mackenzie above Fort Providence is very rapid. Barley, potatoes, and common vegetables grow very well here, and are a welcome addition to the food of the inhabitants, which consists chiefly of fish and water-fowl. In 1891 the gardens were completely devastated by innumerable locusts.

The breadth of the Mackenzie varies from one to three miles. Above Providence it runs through the Little lake, small compared to the Great Slave lake, but of respectable dimensions. At Fort Simpson it is joined by the Liard, which descends from the Rocky mountains, and at Fort Norman by the Bear, draining the Great Bear lake. Between Fort Norman and Fort Good Hope, the Mackenzie flows for about a mile with a velocity of eight miles an hour, and here is navigable only by boats drawing not more than 7 feet of water.

The delta of the Mackenzie is formed by two principal branches in the east and centre, and by another on the west, which is formed by the Mackenzie and Peel. Numerous channels connect these arms, forming a number of low islands covered with firs and willows. Enormous quantities of sand and mud are transported by the river, and, at the break up of the ice, barriers of ice are formed between the islands, causing the water to rise and cut out each year new openings to the sea. The mouth then measures 40 miles across, and a series of shallows are formed, through which a channel two fathoms deep is found not without difficulty. Many new islands are formed such as to the west of Richard Island, where there was sea last century.

In the Admiralty chart there is marked on the eastern side of the delta a river draining a large lake—Eskimo lake. M. de Sainville found the topography to be very different. Leaving the right branch of the Mackenzie at a point about 30 miles below Point Separation and ascending a stream draining a lake of very moderate dimensions, he crossed over to the Natoja river, which flows into the first of the Eskimo lakes, a sheet of water 15 miles long by 6 broad. Out of this a stream flows for 6 miles and then enters a series of brackish lakes, where the tide is perceptible. This series of lakes extends with a length of 30 miles and a breadth of 5 or 6 to the head of Hutchison Bay, and there is no communication by water with Liverpool Bay, except, of course, by sea. The surrounding country is a desert, a succession of prairies and hills covered with moss and full of small lakes and swamps. Flowers and water-birds are abundant in the summer. There is no rock, but all the elevations, which attain a height of 500 feet, as well as the soil of the prairies, are composed of sand and silt. Frequent landslips render the examination of the land very easy, and M. de Sainville found on two occasions hillocks of ice covered with mud and moss at 100 and 200 feet above the mean level of the country. Layers of driftwood and bones were observed at depths of 50 to 100 feet below the water-level. Fossil bones of the American elephant are numerous. Along the coast the water is shallow, but a channel five fathoms deep runs up to the head of Hutchison Bay, which is well sheltered and is the best port to winter in from Bering Strait to Cape Bathurst.

On the west of the delta the country has a totally different aspect, the Rocky mountains running beside the river, though not exceeding 6000 feet in height. M. de Sainville ascended the Peel river, which is navigable for about 60 miles, as far as 65° 33′ N. lat. and 133° 57′ W. long. Its source is only about a dozen miles from the Yukon basin.—*Bull. de la Soc. de Géographie*, Paris, 3e Trim., 1898.

Asiatic Origin of Central American Civilisation.—Prof. E. H. Morse notices this theory in Appleton's *Popular Science Monthly*. The chief support of the theory is the Chinese reports of the land of Fusang, which a Buddhist monk is said to have visited in the years 485 to 499, and in which some authors recognise Mexico. Prof. Morse points out the legendary nature of the narrative, and that there is nothing in the description of the country that points to America, but that East Asiatic, Japanese, or Korean conditions of life are represented. If East Asiatic civilisation had exercised any influence on America it would probably have been from Japan by means of boats carried across by the Kuro Shiwo, or following the chains of islands. But the interesting objects of late discovered in the old shell-mounds and graves of Japan have nothing in common with the manufactures of America. Half-civilised peoples, as the Central American nations undoubtedly were, would certainly have adopted some of the inventions of East Asia, but the plough, stringed instruments, wheeled-carts, chop-sticks, written characters, etc., were unknown in America. Again, tobacco was introduced from America into

Asia in pre-Columbian times, while tea and other useful articles were first brought to America from Asia by the Spaniards.—*Globus*, Bd. lxxv. No. 10.

Puerto Rico.—The most eastern and smallest of the Great Antilles, which has recently passed into the possession of the United States, is 95 miles long by 35 wide, and has an area of about 3700 square miles, or rather more than half that of Wales. It is the most productive of the islands in proportion to area, and is notable as having a population in which the white race predominates. The island is practically a continuation of the Antillean line of upheaval, though it does not attain the great altitudes of other members of the group. It rises from the bank common to the group, which on the north side descends nearly 30,000 feet to the bottom of the Brownson Deep, until recently supposed to be the deepest hole in the world. The outline of Puerto Rico is a nearly regular parallelogram, and the sea-line is almost straight. Nor are there fringing keys and deep indentations as on the coast of Cuba. The central mountains cover approximately nine-tenths of the area. In fact, the whole island is practically an elongated elevated sierra chiefly of volcanic rock, surrounded by a narrow rim of limestone hills, formerly marginal incrustations which have been elevated. Viewed from the sea these mountains have a rugged serrated aspect, with numerous peaks rising above the general mass, which has been eroded into numerous lateral ridges separated by wedge-shaped gorges. The nearest approach to anything like a crest is a line of summits extending about two-thirds of the whole length of the island, from Mayaguez on the west through Aibonito and Adjuntas to Humacoa on the east. West of Aibonito it is called the Central Cordillera and the Sierra de Cayey to the east of that town. About the centre of the island, near Barranquitas, another crest line branches off on the northern side, the Sierra Luquillo, and extends to the north-east cape. When looked down upon from the highest points these mountains present the appearance of a sea of conical peaks and beaded ridges rather than of a dividing ridge. They rise abruptly from the sea, especially at the east and west ends of the island, or from the narrow marginal plain which separates them from it. Only one peak attains a height of 4000 feet, namely, El Yunque, in the extreme north-east, and this, though given on Spanish maps as 4087 feet, is reported to be much lower by other authorities (3790 by the U.S. Coast and Geodetic Survey). The other summits of the island nowhere rise much above 2800 feet.

The rivers have cut deeply into the mountains, leaving between their valleys sharp ridges. The three principal rivers of the north coast have cut their way back nearly across the island. The easternmost, the Loiza, rises only eight miles north of Arroyo on the south coast; the Rio de la Plata rises the same distance from Guayama, and reaches the north coast near the central meridian of the island; and the Rio Grande, rising twelve miles north of Ponce, near Adjuntas, enters the sea near Arecibo.

On the north coast, towards the west, are some exceptionally high hills, extending as far back as Lares and San Sebastian. They are remarkable for their sharp-pointed conical summits of limestone, the remnants of a degraded inclined plateau. The interior hills, which are the most pointed, rise to 1200 feet above sea-level, but stand only 300 to 500 feet above the intervening valleys.

Seen from the sea the coastal topography at the south-west end presents the aspect of a low-tilted bench or plain rising rather abruptly from the shore, and its summit gently curving towards the foot of the ribbed front of the mountains. Here and there the wide alluvial valley of a stream cuts across this bench, dividing it into blocks of hills. These plains are in many cases so extensive that they

exceed in area the remaining hills. Many of the towns of Puerto Rico are situated on the inner border of the plains many miles from their ports. On the north coast the hills rise singly or in chains, separated by broad plains from the mountains of the interior. On such a hill the citadels of San Juan are built. Coastal plains are very extensive along the whole north coast from Arecibo past San Juan to the north-east cape, and Ponce stands on a plain that extends backward up the valley of the Rio Portugues.

Certain streams descending from the mountains tend to bend along the mountain front, or to send out laterals parallel to it. Thus long valleys have been formed at the junction of the mountains and the foot-hills. These are especially well developed on the south side of Puerto Rico, among them being the plain of Saba Grande and the depression of the Guanica lagoon. The former, a long valley running east and west between the mountains of the interior and the Cerro Gordo hills, watered by the Rio Grande of Mayaguez, would by continued erosion soon be reduced to sea-level, so that a long strip of country between the Susua and Rio Grande would be cut off from Puerto Rico.

As the soils of Puerto Rico, except on the coastal plains, are all residual, the distribution of the vegetation is explained in large measure by the geology. The mountains are composed of black or other dark-coloured basic igneous rocks, occurring as tuffs, conglomerates, and sills of hornblende-andesite, cut by dykes of diorite. Though these are rocks of volcanic origin no signs of recent volcanic action are to be found, but all the original volcanic forms have been destroyed by erosion. In this mass of volcanic rocks are imbedded two limestone formations. One of these, found on the crest of the island near Cayey and Aibonito, is a bituminous shaley limestone interbedded with volcanic conglomerate. This calcareous horizon, apparently underlying the crest of the Sierra, is fully 1000 feet thick and weathers into soils noted as the best for tobacco in the island. The other is a light grey crystalline limestone with Cretaceous fossils. It crops out from near Cabo Rojo to ten miles north of Ponce on the Adjuntas road, and has no agricultural value. The upper part of the Pepino hills consists of a hard white marl full of coral heads, with occasional indurated strata of white porous limestone. These rocks are of Miocene age, and their tilted position where they meet the older volcanic rocks at a height of 1200 feet indicates the great movements that must have taken place in late geological times. Below this limestone, at least 100 feet thick, are fossiliferous greensand marls (Eocene or Oligocene) resting in turn on thinly stratified lignitic clays and sands of Eocene age. The south coast hills are loose-textured white limestone, often chalky, which was deposited round the mountainous mass when it was submerged 600 feet lower than at present. They are mostly Pleistocene, though some may date as far back as Oligocene times.

In the Cretaceous period volcanic energy piled up the igneous rocks which form the core of the island. At the close of this period and in the Tertiary these rocks were denuded to form the stratified tuffs, conglomerates, and fossiliferous Cretaceous and Eocene rocks. The vast thickness of white limestone that is found in Cuba, Jamaica, and San Domingo has not been observed on Puerto Rico, but probably this island also suffered great subsidence in Oligocene times. In late Tertiary times it rose again, chiefly before the close of the Miocene epoch, and in Pleistocene times was subject to minor oscillations.

Decay is so rapid under perpetual warmth and moisture that the whole surface is covered with a deep red arenaceous clay soil of remarkable tenacity, so that cultivation has been carried to the very top of the mountains, but owing to overcultivation without the application of fertilisers much of the land has been exhausted and is now abandoned. The reclamation of these lands by afforestation or

new methods of scientific agriculture is one of the problems to be solved by the new owners of Puerto Rico.

An Intercontinental Railway.—The project of a line through Central America and the northern republics of South America which should bring New York and Buenos Ayres into direct communication, was suggested several years ago, and has already been alluded to in this *Magazine*. In 1889 the International American Conference at Washington appointed a commission of engineers to inquire into the practicability of the scheme. The commission concluded its labours in 1893, but has only recently issued its voluminous report. The surveys were commenced at Ayutia, a village on the southern frontier of Mexico, which is already connected, through the Mexican railways, with the United States system. The commission advises that the railway should follow the meridional valleys of the cordilleras, or such as, on the whole, run nearly north and south, towns of importance being connected by branch lines with the main trunk. The main line should follow the axis of the cordilleras from the southern frontier of Mexico to the Titicaca lake, whence it may be continued by railways now existing or projected to Huanchaca in Bolivia, on the eastern side of the Andes. From Huanchaca a short line will be necessary to form a junction with the Argentine system at Jujuy. Antofagasta, Valparaiso, and Valdivia, in Chile, will be reached by a branch line, and a line is also proposed across the plains on the east of Bolivia to Uberaba in Brazil, whence Rio de Janeiro and the harbour of Santos may be reached, while still another will follow the Pilcomayo and Paraguay rivers to Assuncion, and also furnish a means of communication with Uruguay.

The engineers estimate the total distance between New York and Buenos Ayres at 10,228 miles, of which 4771 are already traversed by railways. The cost of the earthworks and bridges of this gigantic undertaking is estimated at £35,000,000 sterling. The most expensive part of the work will naturally be the lines in the Andes of Colombia, Ecuador, and Peru, while the greatest technical difficulties will be encountered in carrying the railway down from the plateau of Bolivia to the pampas of Argentina, where, in a direct distance of 125 miles, there is a difference of level of 6820 feet. In Peru also long windings will be necessary; in one section the line must be thirty miles long while the distance as the crow flies is only six, and in another, where the distance in a straight line is 22½ miles, the railway will be 74. Numerous tunnels, some of them in spiral form, will considerably increase the cost of the Peruvian section, which will be 1785 miles long, out of which 152 miles only have been already constructed.

All the States interested will contribute to the expenses in proportion to the numbers of their inhabitants. Argentina alone has refused to pay its share, but has promised to connect its system with the intercontinental line.—*Globus*, Bd. lxxv. No. 13.

Glaciation in Southern Patagonia.—Dr. Hauthal, who has lately returned from an eight months' journey in the south of Patagonia, has communicated to *Globus*, Bd. lxxv. No. 7, some of his observations on glacial phenomena in this region. He was particularly struck with the number of erratic blocks he met with everywhere between Punto Arenas and the Lago Argentino, one of them between the Sierra de los Baguales and the Latorre plateau having a volume of 7000 to 9000 cubic feet. He believes these blocks date from the same period as some he has seen on the Rio Cachi in the province of Salta. Similar blocks occur also in the pampa between San Carlos and San Rafael in the provinces of Mendoza, as well as farther north in the province of San Juan. These, with other evidence, lead Dr. Hauthal to believe that the glaciers of the cordilleras once extended far to the

east, so that in Patagonia a kind of inland ice existed, while the drift theory holds good for north-eastern Argentina. The layer of pebbles is of great depth on the Latorre plateau, the western edge of the Patagonian pampa which rises in terraces from the Atlantic Ocean. Westwards of this edge the layer of pebbles does not occur, neither in the isolated summits which here stand in advance of the cordillera nor in the hollows. The mighty streams that came into existence through the rapid melting of the enormous masses of ice must have distributed the matter brought from the cordillera fairly evenly over the whole area once occupied by the ice. At present the causes of the sudden retreat of the glaciers can only be guessed at, but it was probably connected with volcanic outbreaks, the last that occurred in Patagonia. After the eruptions a period of increased precipitation with a colder climate again set in, and consequently renewed expansion of the glaciers, which, however, did not by any means attain to the same dimensions as in the period just terminated. The well-preserved typical succession of terminal moraines which lie some forty miles east of the majestic Mount Payne (51° S. lat., 73° W. long.) show how far the glaciers of this second period extended.

Dr. Hauthal has found that this advance of the glacial ice was not local but occurred in the whole cordillera region of Argentina. The terminal moraines already mentioned occur not only in the hollow between the Sierra de los Baguales and the Latorre plateau but also at the east end of the Maravillo and Sarmiento lakes and the Laguna Rica, surrounding them in a semicircular curve. At Lago Maravillo and Lago Sarmiento five clearly marked concentric lines of moraine, 300 to 400 yards apart, may be counted. Besides these terminal moraines, a ground moraine is distinctly perceptible. A sheet of boulder clay, with many striated fragments, extends over a large part of south-western Patagonia and, according to Nordenskiöld, is well developed in Tierra del Fuego. This boulder clay stands at Lago Sarmiento and Lago Maravillo in steep banks on the rock *in situ*, and forms the foundation for the fine terminal moraines. The position of these moraines, as well as the shallow spoon-shape of the eastern extremities of the lakes are a proof that the basins owe their origin in part to the eroding force of glaciers, while the Laguna Blanca and two other shallow lakes in the neighbourhood are entirely the work of glaciers. The original cause of the existence of the two former lakes was probably fissuring connected with the intrusion of granite.

In the neighbourhood of the basaltic Sierra de los Baguales outflows of diorite have covered, and thrust themselves between, the Upper Chalk and the Lowest Tertiary without causing any disturbance in their original bedding. The subsequent upthrusts of granite, on the other hand, have produced violent disturbance of the strata. A fine example is the majestic Cerro Payne, a typical laccolite, which has been denuded to the core. The central granite masses, disintegrated into grand precipitous towers and needles, are surrounded on all sides by dark strata of late Cretaceous age, partially metamorphosed. A very evident proof of the rapid retreat of the glaciers in south-west Patagonia is the absence of moraines between those at the east end of the lakes Maravillo and Sarmiento and the existing glaciers of the cordillera, though erratic blocks are strewn about and glacial striæ are to be seen on the rocks *in situ*. Then the glaciers must have remained for a long time stationary, as shown by the terminal moraines now lying in front of the present glaciers, and then again a rapid retreat began which is still going on.

In close connection with this retreat is the drying-up of the lakes. All the larger lakes in the south exhibit several distinct strand-lines, one above another,

and smaller sheets of water have been dried up within the last five years. The Lago Argentino has in the last twelve years lost a strip of ground on its southern shore, three or four hundred yards broad, and the Laguna Llancanelo in the province of Mendoza, an extensive sheet of water fifteen years ago, is now quite dry. Evidently, also, the whole continent is rising, as Darwin supposed, for a displacement of the shore has taken place in quite recent times in Last Hope Inlet of sixteen to twenty feet, while *Pholades* holes are to be seen on the Cerro de la Cueva, four miles inland, at a height of 1000 feet.

OCEANS.

Oceanographic Observations in Australian Waters.—At the meeting of the Australian Association for the advancement of Science in January 1898, Mr. T. W. Fowler, M.C.E., read a paper on determinations of density and temperatures of the water round the shores of Australia and New Zealand. As the author was unable to spare time to collect samples himself, he applied for assistance to the captains and officers of intercolonial steamships, which was readily granted, and the temperature was noted at the time each sample was obtained. The densities were determined by two hydrometers, the one having a volume of 90½ cub. cm. with a stem diameter of about 5 mm. and the other a volume of 137½ cub. cm. with a stem diameter of about 4 mm. These instruments, made in London, were carefully measured, weighed, and tested in solutions of known densities, on their arrival in Australia. The densities given in tables by Mr. Fowler are the means of three readings of the hydrometer with different weights in each case. The results obtained for each individual reading with the large hydrometer never differed by more than 0·0006 from the mean, the average difference being half that amount. The densities given are those of the sea water at 60° F. referred to distilled water at 39·2° F. as standard.

The samples tested were taken between Fremantle and Melbourne ; between Melbourne and Brisbane, off the coast of Queensland north of Brisbane ; between Melbourne and the Bluff, New Zealand ; between the Bluff by the east coast of New Zealand and Cook Strait to Sydney ; and by the author off Sorento in Bass Straits. Attempts were made to obtain the samples in February and August, as being months of greatest variations, and in May and November when average results might be expected.

The density in the Gulf of St. Vincent is always considerably higher than in the Australian Bight, while the latter shows a lower density in November 1896 than in the previous August or May. The high density in May off the west coast of Australia shown in the *Challenger* reports does not appear in these tables. Lower densities were found between Melbourne and Brisbane in December 1896, and March, April, and May 1897, than in May and August 1896. A remarkable drop in density occurs north of Mackay, Queensland, probably due to the heavy rains discharged into the sea within the Barrier Reef. Peculiar variations in temperature and density are also shown at 46° 16′ S. lat. and 165° 46′ E. long.

Currents in the Pacific.—M. Vossion, French Consul at Hawaii, reports that a Tahitian schooner of only thirty-two tons, manned by natives, which in March last year sailed for Penrhyn island, being damaged in a storm, was driven helpless northwards through the open ocean, and after eighty-one days at sea arrived at Hawaii with its crew quite exhausted. Hawaii is about 2100 nautical miles from Tahiti. The singular point is that the vessel must have crossed the two equatorial currents and the intervening counter-current which are marked on

our charts. M. Vossion therefore infers that the currents must be variable, and the experiences of the captain of the *Aorangi* (Canadian-Australian steamship line) point to the same conclusion.

According to the latter the currents are not only not constant, but vary from season to season. The Hydrographic Office proposes to publish charts embodying all the observations which have hitherto been made on these currents. If such extreme changes in the currents actually exist, the wanderings of the Polynesians in old times can be easily explained.—*Comptes Rendus* of the Paris Geogr. Soc., No. 8, 1898.

MISCELLANEOUS.

The *Southern Cross* has arrived at Port Chalmers, New Zealand, having landed **Mr. Borchgrevink** and his party at Cape Adare.

We regret to have to announce the death of Mr. **G. E. T. Smithson**, Secretary of the Tyneside Geographical Society. It was chiefly through his exertions that the Society was founded, and its success has been due to his constant energy and his earnest desire to enlist geography in the service of commerce. Mr. Smithson died on April 10th at the early age of forty-six.

On p. 116 Mr. W. S. Bruce stated that the eggs of the **Little Stint** (*Tringa minuta*) were first found in 1897 by Mr. Pearson and Colonel Feilden. He now wishes to correct this statement, having learned that breeding-grounds of this bird were first discovered by Middendorf in Siberia, while Mr. Harvie-Brown and the late Mr. Seebohm were the first to collect its eggs in Europe, near the mouth of the Pechora.

A telegram from **M. de Gerlache**, who has arrived at Punta Arenas, announces that he has visited Hughes Gulf and Palmer Land, where he landed and made collections. He then steered for Alexander I. Land, where he penetrated into the pack to 71° 36′ S. lat. in long. 92 W. Here the *Belgica* was obliged to winter. The weather was bad, but the cold was not intense, except in September, when the thermometer fell on the 8th to $-45\frac{1}{2}$° F. Lieut. Danco died on June 5th, but the rest of the party are well. This is the first time a vessel has wintered within the Antarctic Circle.

M. V. Dingelstedt informs us that the Russian Government has in view the construction of a railway from **Alexandropol** (on the line now being made from Tiflis to Kars) to **Julfa** on the Persian frontier. According to the plans of the engineer Wurtzel, the new line will branch off four miles from Alexandropol and run through Kegach, Bugdashen, and Ulukhanlu to Julfa, a distance of 195 miles. The first 23 miles from Alexandropol to Bugdashen runs through a well-cultivated and thickly peopled district, but the next 33 miles are through a perfect desert where water can only be obtained from the deeply sunk bed of the Arpachai at considerable expense. The remainder of the route lies through well-cultivated country producing rice and cotton. Erivan will be connected to the railway by a branch line eight miles long. The estimated cost of the line is £1,300,000, or about £6670 per mile.

This line is regarded as the beginning of great railways which will eventually traverse Persia from north to south, from Julfa and Tabriz, and from Enzeli and Resht, to the Persian Gulf or some point on the Perso-Baluch frontier.

NEW BOOKS.

Spinifex and Sand. A Narrative of Five Years' Pioneering and Exploration in Western Australia. By the Hon. DAVID W. CARNEGIE. London: C. A. Pearson, 1898. Pp. xvi+454. *Price* 21*s.*

The selection of the title, "Spinifex and Sand," though a peculiar and unattractive one, is perhaps justified by its summing up, not inadequately, the results of Mr. Carnegie's long and perilous journey in West Australia from Coolgardie to Kimberley and back. Spinifex, according to him, grows in hummocks, one to three feet high, which are dense masses of needle-like prickles, and from which rises a very coarse grass, about six feet high, quite unfit for animal food. Camels and horses are much injured by having to cross great patches of it. Ten and a half months were occupied by Mr. Carnegie and his gallant companions in travelling, mostly on foot. The distance covered was over 3000 miles, 2500 of these being through unexplored country, except where the routes of Wells, Forrest, Giles, and Warburton cut across it from east to west. Mr. Carnegie's purpose was partly to look for gold, partly to discover the nature of the country, and he very frankly admits that the result was utterly disappointing in both respects. "So far as being of benefit to mankind," he says, "my work has had no better result than to demonstrate to others that part of the interior that may best be avoided." From lat. 25° to 19° the country is absolutely useless. For want of food and water there is not even the possibility of a route for driving cattle from north to south. Yet Mr. Carnegie's account of the journey of his party is a very interesting one. It abounds in graphic, humorous, and pathetic descriptions of their weary searches for water, of their sufferings from heat, fatigue, hunger, and thirst, and of the few natives they met, with their odd habits, simple implements, and life little above that of the brutes. The desert is crossed nearly from west to east by great ridges of sand, often very steep, from fifty to sixty feet high on an average, and so closely set that from sixty or eighty of them had to be crossed in a day's march (once one hundred and five). It was wearing work for both men and camels. The want of water was a terrible trial, and had it not been for the occasional impressment of a native to act as guide to the rock pools, etc., Mr. Carnegie and his companions must have perished. While lamenting the desolation of the desert, Mr. Carnegie does not forget to allude in an appendix to the fertility of the south-west district of the colony, and to the capabilities of Kimberley and the coast region for the raising of cattle, sheep, and horses. The forest area he estimates at 20,400,000 acres. The early chapters of the book describe three short journeys in the neighbourhood of Coolgardie, Hannan's, and Bayleys, when these places were little better than bush, with a few miners' camps. There is a piquant description of the miners and their life. There are good maps of the routes of previous explorers and of Mr. Carnegie's own, the latter giving minute details of the character of the country, situation of water supplies, etc. The index is unsatisfactory.

Cuba and Porto Rico, with the other Islands of the West Indies; their Topography, Climate, Flora, Products, Industries, Cities, People, Political Conditions, etc. By ROBERT T. HILL, of the United States Geological Survey. London: T. Fisher Unwin, 1898. Pp. xxviii+429. *Price* 16*s.*

This is a model of what a geographical handbook should be—in every respect but one. The text is well planned, and well written, and interesting "from title-page to closing line." The illustrations are admirable, but, except for a geological

map of Cuba, there are no maps [1]—a lamentable piece of parsimony on the part of the publishers, considering the lavishness of the other essential illustrations. Good maps are all the more necessary as Mr. Hill has given us some new nomenclature, and only such an authority as he is could have shown the structural relationships he describes in the text with the precision and force that is attained by adequate mapping.

From the very first Mr. Hill rightly insists on the independence of Central America and the West Indies of North America, and points out that the West Indies are from every point of view, physical as well as biological, a continuation of South America. He emphasises the distinctness of the American Mediterranean, or, as we should prefer to call it, the American Midland Sea, from the great oceanic basins, the West Indies separating it from the Atlantic just as Central America does from the Pacific, although not in the same exclusive way. The area of this basin is about half that of Australia, and its land surface is about eighty per cent. of the British Isles. It is a region of whirling waters pouring into the Caribbean Sea through the straits between the Lesser Antilles and the Windward Passage between Cuba and Hispaniola, and pouring out through the Yucatan Channel into the Gulf of Mexico. Thence they rush through the Strait of Florida, and form what we call the Gulf Stream, although the most important part of this current does not come from the Gulf of Mexico at all, but flows outside the West Indies. The deepest part of the Atlantic Ocean is found north of Puerto Rico, in the Brownson Deep, 4500 fathoms. Both the Atlantic Ocean, the Caribbean Sea, and the Gulf of Mexico are very deep, and out of the depths the West India Islands rise.

Mr. Hill divides the West India Islands into the Bahamas, the Great Antilles, the Virgin Islands, the Caribbee or Windward Islands, the South American Islands, and the keys or coral reefs. The Caribbean Chain consists of a double row of islands, an outer and an inner chain, the latter joining the Great Antilles to South America. The Inner Caribbee Chain is composed of old volcanic rock, while the Outer Caribbee Chain is limestone. Tobago, Trinidad, and other South American islands are simply the outstanding land rising above submerged parts of that continent.

The configurations, climates, resources, and social conditions of the Great Antilles are brought out in a series of interesting and admirable chapters which describe each island, most attention being given to Cuba, Puerto Rico, Jamaica, and Hispaniola. Mr. Hill calls Hispaniola, Santo Domingo, to distinguish the island as a whole from the two republics of Haiti and San Domingo, between which it is divided. He notes that the term Hispaniola is not now commonly used, but it is well that it should be.

As a sample of his way of dealing with the social conditions of the islands, we may cite some of his remarks on Jamaica, where he notes the universal order and respect for the law that everywhere prevail. "In fact," he says, "in the government of Jamaica we have an example of that colonial administration in which England (*sic!*) excels. . . . In general the government of Jamaica is humane, civilised, and just. . . . Agriculture is either flourishing or decadent in Jamaica, according to the point of view. The large English estate owners, shorn of the old-time profits of sugar culture, believe that the island is in its decadence, because of the extermination of this industry. Americans and the natives believe, however, that

[1] We have seen the combination of bits of type set within a space about $6\frac{1}{2} \times 4\frac{1}{4}$ inches, covered with a little colour, to form a frontispiece. It is inexcusable in such a book as the present one.

Jamaica has passed through the crucial tribulations resulting from its former dependence upon the sugar-producers, and is entering, for the first time, upon a state of true prosperity, owing to the increasing number of diversified small farms. . . . Notwithstanding its natural beauty, fertility, and superior governmental organisation, Jamaica is suffering from financial depression. There are several causes for this condition. The first of these is the fact that notwithstanding the loyalty of the people to the institutions and government, which tie them to England, their trade and commercial interests are with the United States, which country, through its tariff laws, renders it impossible for the producers to obtain prices which would prevail if the island had free trade with this country. Absentee landlordism is also a great curse to the island. Most of the land titles are held in England, and largely by men and families of fortune, who care little for these estates, since they have ceased to return the immense revenues formerly attainable under the plantation system. The conservatism of the English people also stands seriously in the way of Jamaican advancement." And, we take it, this sane summary of the Jamaica conditions may be applied to other islands.

The book is by far the most important account of the West Indies that we possess.

Gordon in Central Africa, 1874-79. From original letters and documents; edited by GEORGE BIRKBECK HILL, D.C.L., LL.D. Third edition. London: Macmillan and Co., 1899. Pp. xvi+456.

It is probable that the recent successful campaigns in the Sudan and the proposed foundation of a Gordon College at Khartum are the immediate causes why a third edition of General Gordon's journal in Egypt from 1874 to 1879 has been published. In this journal the hero reveals himself to the reader in a way in which no mere biography can hope to compete, and certainly his striking and indeed startling personality is one which more than repays repeated study. Writing to his sister, and obviously without the slightest idea that what he wrote would ever be made public, he sets forth the extraordinary difficulties and dangers of his position and the abject misery and wretchedness of his surroundings in language the simple, truthful eloquence of which leaves nothing to be desired. The journal forms a crushing indictment against the administration of the Khedive Ismail, regarding which there can be but one verdict. For such an administration there was no hope of reform. Based on and saturated with falsehood and peculation, it had to be extinguished and a new structure raised in its place. And yet Gordon, although a sincere Christian and follower of Calvin, had no fanatical hatred of Mohammedanism. He says: "To me it appears that the Musulman worships God as well as I do, and is as acceptable, if sincere, as any Christian"; and again, "I find the Musulman quite as good as many a Christian, and do not believe he is in any peril. All of us are more or less Pagans. I like the Musulman; he is not ashamed of his God; his life is a fairly pure one; certainly he gives himself a good margin in the wife-line, but at any rate he never poaches on others. Can our Christian people say the same?" He held other opinions which would scarcely find acceptance in orthodox circles now. For example, he says: "You ask me what my ideas are of a future life. I think that this life is only one of a series of lives—which our incarnated part has lived. I have little doubt of our having pre-existed; and that also in the time of our pre-existence we were actively employed. So, therefore, I believe in our active employment in a future life, and like the thought. We shall, I think, be far more perfect in a future life, and indeed go on towards perfection but never attain it." To such of our readers

as have not read a former edition of this journal we can cordially recommend the present one.

A History of the Colonisation of Africa by Alien Races. By Sir HARRY H. JOHNSTON, K.C.B. ("Cambridge Historical Series.") Cambridge: At the University Press, 1899. Pp. xii + 319. *Price* 6*s.*

The editor of the Cambridge Historical Series is to be congratulated on having secured the services of Sir Harry H. Johnston to write the history of a colonisation in which he himself has played so prominent and distinguished a part. Within a modest volume of 288 pages Sir Harry has compressed the story of the colonisation of Africa by the Portuguese, the Spaniards, the Dutch, the French, the Italians, the Germans, the Belgians, and the British, and also a brief but graphic account of the invasions of Africa by the Phœnicians, Greeks, Romans, Vandals, Arabs, Turks, and Moors. We have also a dispassionate account of the slave-trade, with the suppression of which the author had so much to do, and a fairly impartial account of Christian missions. No account of African colonisation would be complete without some notice of the great explorers, and Sir Harry, in this branch of his subjects, begins with Herodotus and ends with Mr. H. Cavendish. In a word, he has accomplished his task with thoroughness and yet with clearness, and the reader is impressed with the well-balanced acumen and judiciousness with which he has selected what is really important and rejected what is immaterial in a huge mass of detail which in undisciplined or incautious hands could hardly have failed to be unmanageable and obscure. He has lived so much in Africa, and has himself contributed so much to make the history he relates, that he is bound to have and to hold strongly his own opinions on many subjects which fall within the scope of this work, and he has not hesitated to indicate them now and again. But they are never obtrusive or distracting to the attention of the reader. As a fair example of his style we may quote his sagacious remarks on the probable future of the former slave tribes. "The white and yellow peoples have been the unconscious agents of the power behind nature in punishing the Negro for his lazy backwardness. In this world natural law ordains that all mankind must work to a reasonable extent, must wrest from its environment sustenance for body and mind, and a bit over to start the children from a higher level than the parents. The races that will not work persistently and doggedly are trampled on, and in time displaced, by those who do. Let the Negro take this to heart; let him devote his fine muscular development in the first place to the setting of his own rank, untidy continent in order. If he will *not* work of his own free will, now that freedom of action is temporarily restored to him; if he will not till and manure and drain and irrigate the soil of his country in a steady laborious way as do the Oriental and the European; if he will not apply himself zealously under European tuition to the development of the vast resources of Tropical Africa, where hitherto he has led the wasteful, unproductive life of a baboon—then force of circumstances, the pressure of eager, hungry, impatient, outside humanity, the converging energies of Europe and Asia, will once more relegate the Negro to a servitude which will be the alternative—in the coming struggle for existence—to extinction. The Negro has been given back his freedom that he may use it with a man's sense of responsibility for the waste of time and opportunities—not that he may squander away his existence with the heedlessness of those anthropoid apes to whom in a minute fractional proportion he is more nearly allied than are we, his present guardians."

The volume is equipped with eight useful maps, the most remarkable of which

is the one showing the colonisability of Africa. From it we gather that the area in which Europeans may hope to make their homes is confined to a thin strip on the north-west coast and the tract which lies south of the town of Salisbury. The coast strip to the north is in the hands of the French and the Sultan of Morocco. The tract on the south is held mostly by the British and the Germans. There is also a good index and an appendix of books specially useful to those who are interested in the subject of African colonisation.

Die mittleren Hochländer des nördlichen Deutsch-Ostafrika. Wissenschaftliche Ergebnisse der Irangi-Expedition 1896-1897 nebst kurzer Reisebeschreibung. Im Auftrage der Irangi-Gesellschaft herausgegeben von dem Führer der Expedition C. Waldemar Werther. 4to. Pp. 493. 5 Plates, 126 Figs., 2 Maps. Berlin: H. Paetel, 1898. *Price* 18 *M.*

Premier-Lieutenant C. Waldemar Werther was the organiser and leader of an expedition to Irangi in 1896-1897, and he has edited an account of the exploration and its results. There was talk of gold as a possibility, and there was the certainty of gaining geographical and geological information, on the strength of which possibility and certainty an "Irangi-Gesellschaft" was formed in Hamburg, and an expedition sent off. We wish other companies would follow their example, and issue authoritative reports, making sure of some science, even if they fail to find much gold, adding, that is, to "wisdom," if not to "rubies."

The handsome volume is divided into six parts, in the first of which Lieutenant Werther gives an account of the journey and the bio-economic conditions of the regions through which the travellers passed. This part of the book has much general interest, and we are pleased to see that the editor—with the practicality which we should expect from a military officer—has not padded his narrative with observations which the abundance of exploration-literature has rendered unnecessary and tiresome.

In the second part of the book the geographical results are discussed by Lieutenant Werther and Dr. B. Hassenstein, the astronomical determinations by Herr G. Witt, the hypsometric and meteorological observations by Dr. E. Wagner.

The third part is geological, and is contributed by Herr Leopold von Tippelskirch, who discusses over three hundred rock specimens. As far as useful minerals were concerned the results of the expedition were wholly disappointing.

In the fourth part the mammals are treated of by Herr Paul Matschie, the birds by Professor A. Reichenow, the reptiles and amphibians by Dr. G. Tornier, the insects by Professor F. Karsch and Herr H. J. Kolbe. The two succeeding parts are ethnographic and linguistic by Professor F. von Luschan, A. Seidel, and Lieutenant Werther. It is impossible to give in brief space any summary of the interesting results of this many-sided book; it must suffice to say that it seems a model of what such a work should be—complete in its outlook, co-operative in its execution, handsome in its manner of publication, and unified by a skilful editor.

Kleines Statistisches Taschenbuch über alle Länder der Erde. Nach den neuesten Angaben bearbeitet von Professor Dr. Friedrich Umlauft. *Statistische Tabelle über alle Staaten der Erde.*

The new editions of these useful little publications do not differ in general arrangement and contents from those of former years. They have been brought up to date as usual, and are useful for reference.

Travels and Adventures of the Turkish Admiral Sidi Ali Reis. Translated from the Turkish, with Notes, by A. Vambéry. London: Luzac and Co., 1899. Pp. xviii + 123. *Price* 5*s.*

If we were to search in the history of England for one whose proclivities and accomplishments resembled in many respects those of the Turkish Admiral Sidi Ali Reis, it is to the story of Sir Walter Raleigh that we would have to turn, and Sir Walter was born in the very year in which his Turkish rival commenced the expedition, a delightful account of which is given in the translation now before us. Both Sidi Ali Reis and Raleigh were soldiers, sailors, courtiers, diplomates, patriots, mathematicians, pious theologians, and geographers. Sidi Ali Reis was a poet and Raleigh was a historian. The Turk's travels, adventures, and exploits were in the East; those of Raleigh were in the West. But the Turkish Admiral did not need to imitate the English one in dangling about a court, wasting his time pretending to make love to an affected, capricious, parsimonious, ungrateful, faded old beauty; and his services, which were unimportant as compared with those of Raleigh, were not rewarded by a long and unjust imprisonment, terminated only by a dishonourable death.

Sidi Ali Reis came of a noble and warlike stock. His father and grandfather before him had been stewards of the arsenal at Galata, and he distinguished himself as a young man under the Turkish naval commanders Khaaieddin (Barbarossa) and Sinan Pasha. The fleet of his master Sultan Suleiman had been sent in 1552 to the Persian Gulf to check the progress of the Portuguese, but had met with disaster owing to the incapacity or venality of its commander Piri Bey, who on the appearance of the Portuguese fleet left his own ships at Basrah, and returned to Suez and thence to Adrianople, where he was executed for treachery. Sidi Ali Reis was then directed to take command of the fleet at Basrah. He proceeded there overland, but he also was worsted by the Portuguese after a gallant fight, and had to fly to the coast of Gujarat, where he landed. Thence he returned home *vid* Delhi, Afghanistan, Transoxania, and Persia, taking some three years to accomplish the journey. His account of his experiences in these different countries is extremely interesting and amusing, and we cannot help admiring the adroitness and courage with which he dealt with all classes from the Moghal on the throne to the robbers of the Sind desert. His skill in versifying stood him often in good stead, and a well-turned couplet seemed to be able to effect more than threats of the wrath of the Sultan. Sidi Ali Reis was in Delhi when the Emperor Humayun met with the accident which caused his death, and he had the good fortune to meet his son the famous Emperor Akbar, who with his usual insight into character promptly offered the Turk high preferment if he would join his service. But the Admiral, although after the loss of his fleet he could be by no means sure of meeting with a favourable reception at home, was loyal to his master, refused the offer, and secured permission to proceed on his journey by some verses on the death of Humayun. We have no space to follow the Admiral further in his adventures, but we may assure our readers that the story is told with a simplicity and graphic power such as we expect from an upright and gallant sailor. On his return to the Sultan, the Admiral was received with great favour, and was soon promoted to the office of paymaster to the army, a fact which speaks volumes as to the estimation in which he was held by the Sultan. He retained the office till his death in 1572—a very different ending from that of Raleigh in 1618.

Professor Vambéry has translated and edited the work with his usual judgment and skill, and has freely pruned it of "flowery speeches, synonyms and bombast, unessential to the right understanding of the text."

River Development, as illustrated by the Rivers of North America. By Professor J. C. Russell, University of Michigan. ("The Progressive Science Series.") London: John Murray, 1898. Pp. 327. *Price* 6*s.*

Physical, like palæontological, geology being so vast a subject, is now treated of by specialists in its various more important provinces. Thus, whilst one man devotes himself to the study of mountains, another, like Professor Russell, studies rivers, and gives us this excellent work as the fruit of his labours. Although the author's style lacks the ease and lucidity which distinguish that of so many great scientific writers, his arguments are as sound as his researches have been thorough.

Whilst streams and rivers are subjected to the most detailed examination, and their leading characteristics are represented by excellent illustrations (photographic and otherwise), we may refer to the author's explanation of River-terracing as an effort to elucidate a subject of considerable difficulty. He tells us that the terraces which may be traced for miles along both banks of most rivers are principally due to the following three causes, viz.:—"1st, the normal changes in a stream valley due to the successive processes of corrasion, flood-plain building, and re-excavation; 2nd, climatic changes which cause variations in the volumes of streams or lead to excessive deposition for a time, and the re-excavation of the partially filled valleys; 3rd, oscillations in the land which vary the rate of corrasion and of deposition."

The theory that River-terracing is due to successive elevations of the land (being the 3rd cause just stated) was, although Professor Russell does not say so, advanced long ago by Sir Charles Lyell, and will be found in his *Manual of Elementary Geology* (5th edition. London: John Murray, 1855. Pp. 84-5), where he enters upon Professor Russell's own province and takes the basin of the Mississippi as an example. Lyell also stigmatises as "a rash inference" the belief that "rivers in general have grown smaller or become less liable to be flooded than formerly," maintaining that the great alluvial deposits bordering rivers "would be a natural result of considerable oscillations in the level of the land experienced since the existing valleys originated." Whilst Professor Russell holds that the melting of the ice of the glacial epoch led to the formation of river terraces, Lyell's theory implies that a river-terrace is no temporary "flood-mark," but a vestige of the debris deposited when the river placidly flowed for a prolonged period at the level of the terrace.

Deutschland. Einführung in die Heimatkunde. Von Friedrich Ratzel. Leipzig: Grunow, 1898. Pp. viii + 332.

This volume forms one of a series of "Useful Books for Everybody," and certainly Professor Ratzel's account of Germany is interesting enough to be read by all. At the same time it is characterised by a masterly power of lucid generalisation, and is full of suggestions for the geographer.

It is divided into four parts: The Position and Area of German Land; The Lakes and Coasts; The Climate, Plants, Animals, and Agriculture; People and States. In the last section Professor Ratzel states that thirty million Germans live outside Germany, of whom eleven are in Austria-Hungary, two in Switzerland, three in Belgium and Luxemburg, four in Holland, seven in North America, one in Russia, and two scattered throughout the world. This, however, includes the Flemish and the Dutch, who are not Germans any more than the Danes. Professor Ratzel seems to realise this, for he says, "The people of the Low Countries feel themselves a separate people. Who can contradict the real historical accuracy of this feeling? But their position, like that of the Scandinavians,

is in the closest economic relationship to the Germans, and one day they will see that their isolated position, at least in economic matters, is quite unsuitable in the present conditions of the world."

Zur Zoogeographie der landbewohnenden Wirbellosen. Von Dr. Otto Stoll. Berlin: R. Friedländer und Sohn, 1897. 8vo. Pp. 113. 2 Plates. *Price 4 marks.*

Professor Stoll gives a short account of the geographical distribution of terrestrial invertebrates, from worms to molluscs; a particular discussion of the distribution of the species in the mite-genus *Megisthanus*, and in the gasteropod-genus *Clausilia*; and formulates a number of general conclusions, such as the following:—

In all the groups discussed there are some forms whose wide distribution makes it necessary to postulate land-connections no longer in evidence, *e.g.* between S. America and Africa, and between Chili and Australia. In another set of forms—probably pre-Tertiary relicts—the present distribution forcibly recalls the geographical conditions of the Mesozoic epoch. While the northern hemisphere is regarded as the cradle of many races, there are various forms whose distribution suggests an origin in the south, in some cases, indeed, beyond the Equator. Professor Stoll points out how hazardous it is to infer from the present headquarters the position of the original cradle, and forcibly shows the inadequacy of our knowledge in his discussion of the occurrence of boreal forms in the south, or of the affinities between the fauna of Madagascar and that of tropical S. America.

It would be a large order to discuss Professor Stoll's conclusions, and we cannot do more than welcome his contributions to the difficult problems of zoogeography. It seems to us strange that he should have in this little book repeated the two plates of mites, which were all very well in their original place of publication, but seem rather out of perspective here. A few simple maps would have been much more to the point.

Geology for Beginners. By W. W. Watts. London: Macmillan and Co., Ltd., 1898. Pp. 352.

This is one of the best elementary geologies that we know. The arrangement of the matter is good, and the treatment of the different sections is clear and readable. A very large number of interesting geological photographs have been reproduced, which admirably illustrate the main points in the text, and will be most useful to students. The last two chapters, on the origin of landscape and on economic geology, are specially to be commended.

L'Atlas Marocain d'après les Documents originaux. Par Paul Schnell. Traduit avec l'Autorisation de l'Auteur par Augustin Bernard. Paris: Ernest Leroux, 1898. Pp. 316.

The original work was issued in 1892 as an Ergänzungsheft to *Petermanns Mitteilungen*, and was reviewed in vol. viii. p. 666 of the *Magazine*. It is a careful summary of the geography of the Atlas, collected from a great variety of sources, and deserves to be more widely known through the present excellent translation by Professor Bernard, a member of this Society. We are glad to learn from the preface that Professor Schnell intends this year to publish another volume on Northern Morocco.

Gazetteer of the Dera Ghazi Khan District. Compiled and published by authority of the Punjab Government. Lahore: Civil and Military Gazette Press, 1898. Pp. xii + 194 + lvi. *Price Rs.* 3-6-0.

We have received from the Government of the Punjab a new edition of the Gazetteer of the Dera Ghazi Khan district, revised and brought up to date by Mr. A. H. Diack, I.C.S. The original gazetteer was issued in 1885; what of it dealt with the land settlement has been practically rewritten, and the other chapters have been freely altered so as to bring them into accordance with the last census, and as far as may be the present *status quo*. The gazetteer of an Indian district is and must always be "caviare to the general," but if any of our readers wish to know something about Dera Ghazi Khan, a thinly populated but politically, or rather strategically, important district adjoining Baluchistan, they will probably find what they want in this volume. Commencing with a general description of the district—the geology, flora, and fauna of which are unimportant—it goes on to give a condensed but interesting sketch of its history, tribes, and castes, with their social and religious life, etc. The remaining chapters deal with production and distribution, administration and finance, with some account of the principal towns, only one of which has over ten thousand inhabitants. The volume concludes with over fifty tables of statistics.

The Statesman's Year-Book for the Year 1899. Edited by J. Scott Keltie, LL.D., with the assistance of I. P. A. Renwick, M.A., LL.B. London: Macmillan and Co., 1899. Pp. xxxii + 1248.

The new issue is well provided with maps, showing the late political changes that have taken place in China and Africa, and one showing the French shore in Newfoundland. In the text other boundary questions are noted, and some new statistical tables are added.

The Australian Handbook, Shippers', Importers', and Professional Directory and Business Guide for 1899. London, Melbourne, etc.: Gordon and Gotch. Pp. 640.

Tables showing the movement of population and the progress of commerce in the Australasian colonies during the years 1861 to 1897 are the principal new features in the present issue. Some of the maps, as that of rainfall, show marked changes. In the list of exploring expeditions, that of the Hon. D. Carnegie is most unaccountably omitted, though his route is marked on the map. The *Australian Handbook* has now reached its thirtieth year, and has no doubt a long future before it.

Northern France from Belgium and the English Channel to the Loire. Northern Italy, including Leghorn, Florence, and Ravenna. The United States, with an Excursion into Mexico. Leipzig: Karl Baedeker, 1899.

Each new edition of Baedeker's guides contains some small improvements, new maps, etc., besides being brought up to date. Most of the guides have been so thoroughly worked up that great changes are not to be expected, and it is only necessary to announce their appearance. The United States guide, which has met with much approval, is only in the second edition. It is the work of Mr. J. A. Muirhead.

NEW MAPS.

THE WORLD.

ERDOBERFLÄCHE, Verteilung der mittleren jährlichen Regenmenge auf der ——. Von Prof. Dr. A. Supan. *Petermanns Mitt., Tafel* 13, 1898.

MEERESOBERFLÄCHE, Temperatur-Anomalie der ——, nach Prof. Dr. W. Köppen. *Petermanns Mitt., Tafel* 19, 1898.

COTON, La Culture du —— dans le Monde. *Annales de Géographie, July* 1898.

ASIA.

KLEINASIEN, Uebersichtskarte von ——. Bearbeitet von Dr. Ernst Friedrich. Massstab 1 : 2,500,000. *Price* 1*s.* 6*d.*

——, Handels- und Produktenkarte von ——. Bearbeitet von Dr. Ernst Friedrich. Massstab 1 : 2,500,000. *Price* 2*s.*

Halle a/Saale, Verlag von G. Sternkopf.

The first map, the topography of which forms also the basis for the second, is compiled from the most recent data. The names of the different races who people Asia Minor are printed on the map in red. Two little insets, one showing the temperature, rain, and the direction of the wind, the other giving the region of the Bosporus, are valuable additions.

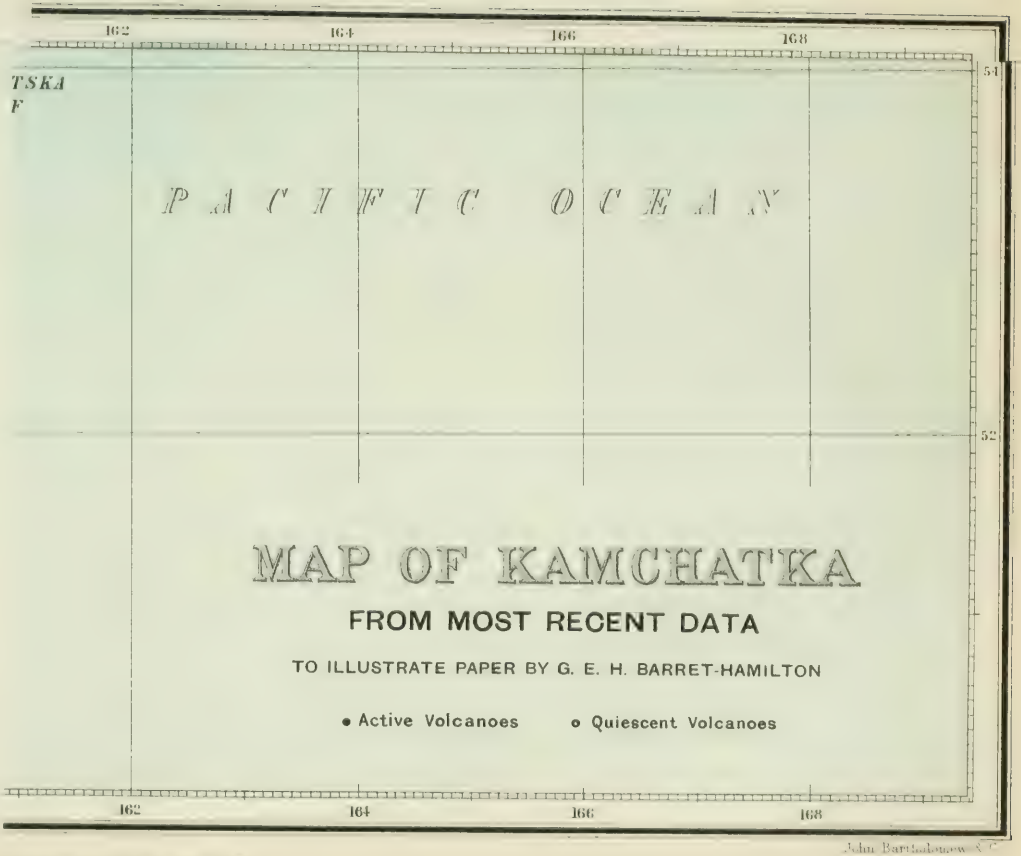
The second map, the more important of the two, deals with the vegetable, animal, and mineral products of the country, and is accompanied by two small insets, showing density of population, and an isochronic chart showing distances from the coast, reckoned by the time the journey occupies. The Vilayet and Sanjak boundaries are laid down, and a copious index, which gives for a certain number of places, where reliable data were at the disposal of the author, additional information about consular representation, commerce, customs, post-offices, etc. The map, which has been carefully prepared, is rather overcrowded with names of products. The author has attempted to give too much, which will mar the usefulness of the map for business people who have not the time or patience to study a map minutely.

CHINE, Carte Industrielle de la ——. Par Louis Seulfort et Francis Laur. *Prix* 18 *Frcs.* *Société des Publications Industrielles, Paris.*

This map, which has been published at a very opportune time, when the commercial and industrial world is so much occupied with the affairs of the Far East, deals with the railways and telegraphs, and the distribution of mines and foundries, known at the present time. The official position of the authors is a guarantee for the accuracy of their information, based on the most recent and unpublished data. The map, drawn rather in a bold and sketchy style, will serve the purpose for which it has been designed, but the high price will prevent a large circulation amongst those interested in China.

AMERICA.

KLONDIKE GOLD FIELD, Map of the —— and vicinity. Including latest official surveys by Departments of Dominion Lands and Geological Survey. By J. B. Tyrrell, M.A., F.G.S. *Presented by the Author.*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PACIFIC OCEAN
MAP OF KAMCHAT'KA
FROM MOST RECENT DATA
TO ILLUSTRATE PAPER BY G. E. H. BARRET-HAMILTON
• Active Volcanoes
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PENZHINSKA GULF
OLUTORSKA GULF
KARAGINSKI I.
UKINSK BAY
BERING SEA
PACIFIC OCEAN
SEA OF OKHOTSK
GULF OF KAMCHATKA
KRONOTSKA GULF
COMMANDER IS.
Bering I.
Copper I.
Yamskun Bay
Yamskoi Is.
Tigilsk
Paroshmikof
Zagri
Ilpeleken V.
Mironshinzana
Shevelluch
Klyuchevskaia
Ushkinska V.
Cr. Tolbachа
Herbert Stewart
Lat Tolbachа
Gordon V.
Losaky or Sopochnaia V.
Icha V.
Chapina V.
Unana V.
Kizimen V.
Tauzhitz V.
Khamchen V.
Uzon V.
Kronotskaia
Kishpinich
Kolokonova
C. Semiachik
Bakkening V.
Zhupanova V.
Koriakska V.
Avachundra
Bolshereisk
Vilutchinsk V.
Apacha
Povorotnaia
Asacha
Vine V.
Kekuknich V.
Utashun
Tuma V.
Chaokhta
Alaid I.
Topaika
Kuril Strait
Shumshu I.
Paramushir I.
Little Kuril Str.
Amphitrite Str.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

THE HYDROGRAPHY OF THE CAUCASUS.

By Victor Dingelstedt, Corr. Member.

(With a Map.)

Introductory.—Under the name Caucasus we understand the extensive region administered by the Governor-General appointed at St. Petersburg, and containing twelve Governments or Provinces. This extension of the word may not be geographically correct, but it seems unavoidable until the further penetration of Russia into Asia Minor compels her to divide her possessions into two or more parts, each with a more appropriate geographical name.

It is just ten years ago, that, in his paper on the "Geography of the Caucasus" (*S.G.M.*, vol. v. p. 348), the author gave a short retrospect of geographical work in this country, and showed that, though dating far back into remote times, and not without considerable importance, exploration was not adequate to the interest of the subject. Since then a period of intense scientific progress has elapsed. The past decade has not been without some happy results in the study of the Caucasus, which was visited on the occasion of the last Geological Congress by a number of eminent geologists and geographers. It would occupy too much space were we to enumerate here all the works that have appeared in the last ten years on this subject. In the pages of this *Magazine* alone there have been given above fifty notes and articles about it. Among recent works deserve a special mention the excellent book of Mr. D. W. Freshfield, *The Exploration of the Caucasus*, reviewed in vol. xiii. p. 33 of the *S.G.M.*, and two Russian papers, that of Colonel Lissovski in vol. xx. of *Zapiski* of the Caucasus section of the I. R. Geog. Society, and that of Mr. Apostolof in vol. xxiii. of the *Sbornik materialoff dlia opisania*

miestnostei i plemen Kavkaza. The author of this paper, who has contributed articles on the Caucasus on previous occasions, has thought it not inopportune to present a succinct account of the drainage of this country. Since the days when Sir Charles Lyell directed the attention of the world to the very important natural phenomena connected with streams, the subject has immensely increased in interest, and continues to occupy the attention both of geologists and geographers. It has a peculiar importance in such a mountainous country as the Caucasus. Its greatest treasure are its streams; they have sculptured its present sublime and beautiful outlines, excavated its valleys and gorges, filled up its plains, watered and manured its fields, given life and joy to what without them would be a parched desert and a picture of desolation, and more than all they are capable of furnishing motive power sufficient to create, with a little more progress and civilisation, flourishing industries, wealth, and prosperity.

Already in the mythological period of Greek history in the time of Herodotus and Strabo, the Caucasus was famous; it was long the theatre of bloody struggles, but now, inhabited by ancient and intelligent races, living under a strong, able, peaceful, and orderly government, it has a fair chance of becoming rich and renowned again.

Area.—The Caucasus, situated between 45° 17′—38° 46′ N. lat. and 36° 40′—49° 51′ E. long., has an area which is variously estimated from 172,494 to 180,843, 181,127, 182,443 (Stebnitzki in *S.G.M.*, vol. iv. p. 610), and even 183,923 square miles. We take the last number as being in accordance with the latest information given in the official *Kavkazki Kalendar* for 1898. This area is more than half as large again as that of the United Kingdom. This large region is intersected by numerous mountain chains, which separate the drainage into four principal basins: that of the Sea of Azof and the Black Sea, north of the main chain, 50,330 square miles; that of the Black Sea, south of the main chain, 39,285 square miles; that of the North Caspian, 39,285 square miles; and that of the South Caspian, 55,023 square miles.

Nomenclature.—Before proceeding further, some remarks may be necessary for the better comprehension of the names here employed. There is no small difficulty in the subject, as some confusion exists in names of Caucasian rivers and mountains. There are local names in different languages spoken in the countries traversed by the rivers and mountains; there are different names given to the same mountain or river in their different parts; there are Russian, vernacular, and ancient names; there are names adopted in Western languages; and, to crown the confusion, appellative names mistaken for proper. We shall employ in this paper the names as they are spelled in Russian, transliterated according to the scheme given in vol. viii. p. 31 of this *Magazine.* Many of these appellative terms retain their meaning in the Eastern languages from which they were derived, which it is useful to know. Here are some of the most frequent:—*chai,* river; *su, ab, tskhali* signifying in Tartar, Persian, and Georgian stream or secondary river; *don, daria* also river; *selaf* or *sael,* mud-torrent; *arkh,* canal; *tskharo,* spring; *bulak,* spring; *tau, darassy,* mountain-top; *kala,* cliff or bluff; *khevi,* dell; *bassar,*

river-basin; *dasht*, plain. (See also some terms given in the *Magazine*, vol. ix. p. 457.)

Sources of Supply. Rain and Snowfall.—The great majority of the streams of the Caucasus are dependent upon the direct supply from rain or surface springs, the glaciation not being extensive, and calcareous rock capable of retaining moisture in deep-seated springs being of comparatively small extent. There are now in the country 141 stations, where, under the general supervision of the Physical Observatory of Tiflis, the precipitation is recorded. Thirty-six of them are in the Northern Caucasus, the rest in Transcaucasia. Thus there is one station for about 2500 square miles in the former, and for about 900 square miles in the latter part of the country. For a hilly country they are certainly far from sufficient for any accurate observation of so complex a phenomenon. In Switzerland, over an area eleven times smaller, there are 300 rain-gauges, and these are not considered sufficient. But we obtain nevertheless a tolerable approximation to the truth. The rain is very unequally distributed. On the eastern shore of the Black Sea, in Sochi and Batum, fifteen times as much rain falls as on the Aras, in Kulp, in Aralykh, and Boasta, the extreme numbers being 2370 mm. (93·3 in.) annually in the former, and only 137 mm. (5·4 in.) in the latter case. Here follow the mean annual quantities taken from official sources, widely different from those drawn from the *Deutsche Rundschau* in vol. xii. p. 363 of this *Magazine*. The numbers in parentheses indicate the altitude in feet.

From 1500 to 2370 mm. (59 to 93·1 in.). Eastern shore of the Black Sea.
„ 1250 to 1500 mm. (49 to 59 in.). Kutais, Lailashi (2848), Gudaur (6601).
„ 1000 to 1250 mm. (39 to 49 in.). Kobi (6578), Lenkoran.
„ 750 to 1000 mm. (29½ to 39 in.). Alaghir (2031), Oni (2749), Ardagan (5840), Biely Kliuch (3773).
„ 500 to 750 mm. (19½ to 29½ in.). Mozdok, Grozny, Suram (2408), Sadon (3297), Khunzakh (5249), Deshlagar (1975), Abas-Tuman (4134), Borzhom (2559), Manglis, Nukha (2454), Sarikamysh (6890), Shusha (4488), Piatigorsk.
„ 400 to 500 mm. (15¾ to 19½ in.). Temriuk, Ghelenjik, Petrovsk, Tiflis, Akhaltsikh (3379), Kars (5715), Novobaiazet (6385).
„ 300 to 400 mm. (12 to 15¾ in.). The steppes north of Piatigorsk, Akhty, Kusary, Alexandropol (5000), Erivan (3258), Ordubat (3120).
„ 200 to 300 mm. (8 to 12 in.). Kizliar, Kaghyzman (4619), Jagry (3445), the lowlands of the Kura and Aras.
Under 200 mm. (8 in.). On the North Caspian shore (Boasta), at the foot of Ararat, Aralykh (2753).

What is surprising in these numbers, and, certainly, not to be accepted without some caution, is the small influence exercised in some cases by the altitude of the points of observation. We have, it is true, some high stations, such as Gudaur and Kobi, which indicate an abundance of precipitation; but, on the other hand, there are points situated as high as Kars, Novobaiazet, Alexandropol, Kaghyzman, and Jagry, which rank

as to the quantity of their rainfall with stations such as Temriuk, Ghelenjik, Petrovsk, Akhty, and others, which are at sea-level or even a few mètres below it. Perhaps the discrepancy is to be attributed to the difficulty of accurate observation of the snowfall, which is included in the evaluation of mean annual rainfall, and which is more frequent in the mountains. It is also not easy to understand the considerable differences in the indications of the rain-gauge at points so near and so similarly situated as, for instance, Divnoe, 287 mm. (11·3 in.), Medviezhie, 423 mm. (16·7 in.), mean annual; Abedati, 1813 (71·4 in.), and Kutais, 1348 mm. (53·1 in.); Mozdok, 499 (19·6 in.), and Naursk, 260 mm. (10·2 in.); but the rain is capricious.

Advancing from the north to the south the rainfall increases till it arrives at its maximum in lat. 43°-42°, in which extends the main chain; then it quickly decreases. The mean annuals according to the latitude are as follows:—

Between	46°-45°	mean annual	470	mm.	(18·5½ in.).
,,	45°-44°	,,	590	,,	(23 in.).
,,	44°-43°	,,	597	,,	(23·½ in.).
,,	43°-42°	,,	948	,,	(37 in.).
,,	42°-41°	,,	677	,,	(27½ in.).
,,	41°-40°	,,	372	,,	(14½ in.).
,,	40°-39°	,,	325	,,	(13 in.).

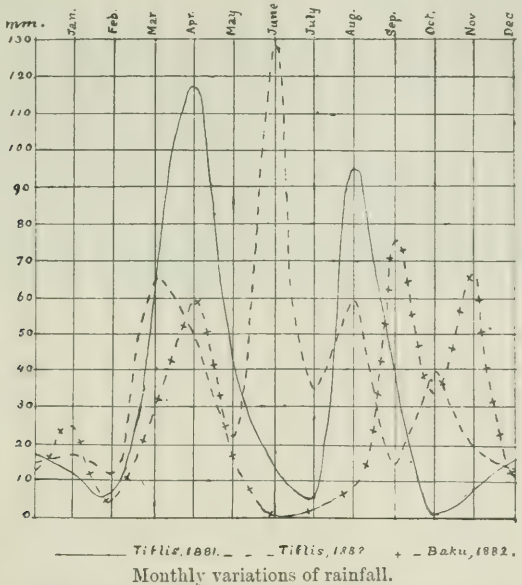
From west to east the rainfall rapidly increases; from 501 mm. (20 in.) annually between the meridians 37°-38° east of Greenwich, it becomes 547 mm. (21½ in.) at long. 38°-39° and 1320 mm. (6 in.) at long. 39°-40°. Then it maintains an average of 946 mm. (37 in.) eastwards to 43°; after which it considerably decreases, the annual mean between long. 43° and 50° being about 510 mm. (20 in.).

In respect of precipitation, the country may be roughly divided into two regions, the well-watered and the dry. The first embraces principally the south-eastern basin of the Black Sea; it has an area of about 188,000 square kilomètres (72,600 square miles), and a rainfall from 650 up to 2370 mm. a year, with an average of 950 mm. (37½ in.); which gives annually about 179 cubic kilomètres (43 cubic miles). The second, eastern part, appertaining mostly to the Caspian basin, has an area of about 282,000 kilomètres (109,000 square miles), or 60% of the whole; it has a mean annual rainfall of 515 mm. (20 in.), which gives a volume of water of about 145 cubic kilomètres (34 cubic miles). The total volume of water the country receives annually is therefore 324 cubic kilomètres (77 cubic miles), corresponding to an average rainfall for the whole country of 689 mm. (27 in.) annually.

It rains rather more in the spring and summer than in the other seasons, the proportion being as 58% to 42% in the Northern Caucasus, and 54% to 46% in Transcaucasia. On the south-eastern shore of the Black Sea (Batum, Artwin), as also in Lenkoran, most rain falls in the autumn; whilst in the vicinity of the Sea of Azof the winter is the wetter season.

We have no very exact data concerning the snowfall, which, in con-

sequence of defects in the apparatus used to gauge it, is to be considered as a rather disturbing element in the evaluation of the precipitation. In the Northern Caucasus and at high levels it snows from November to March; it snows but very little and seldom in the low plain of the Kura and Aras, and scarcely ever in the south-eastern corner of the Black Sea.



Monthly variations of rainfall.

The perennial snow-line is at an altitude of 9600 feet in the western part of the main chain, at the sources of the Rion; at 10,500 feet in the Central Caucasus, from the Passimta to Barbalo; and at 12,200 feet in the eastern part of the chain, from Barbalo to the Shakh-dagh, thus continually rising from west to east. On the southern slope the snow-line descends some 1000 to 1500 feet lower than on the other side, which is owing to the dryness of northern and north-eastern winds, arrested by the "lateral" chain, and thus despoiled of the little humidity they may contain. The main chain is covered with perennial snow for some 200 miles, that is for about one-fifth of its length. But we should by no means consider the region of perennial snow as of fixed extent; for the snow-line is not a definite immovable line, as was well explained by Dr. E. Brückner in the *Meteorologische Zeitschrift*, January 1887 (*S.G.M.*, vol. iii. p. 152), but one which varies both in space and time.

Outside the Caucasian range there is only Mount Ararat which, in the country under consideration, rises into the region of perpetual snow. Its snow-line is estimated to be at about 12,930 feet of altitude at its southern, and about 800 feet higher on its northern, slope (*S.G.M.*, vol. viii. p. 455).

Glaciers.—We must say a few words on glaciers, as they are a very important source of supply for rivers, as also a powerful agent of

erosion and transport. According to Mr. Freshfield (*S.G.M.*, vol. xiii. p. 33), the total approximate area of glaciation in the Caucasian range is from 625 to 650 square miles. It was certainly far more considerable in past times in the Glacial periods, the vestiges of which are so numerous and to which is to be ascribed the formation of cirques so common in the Caucasian range. The study of Caucasian glaciers is but little advanced; there are great difficulties in the way and but scanty enthusiasm. And therefore there is the more reason not to leave in oblivion the few courageous men who have dared to face these glacial and frightful solitudes. In particular, we would mention the names of Khatissian and Pastukhof. The former visited during many years and examined attentively the largest glacier in the Kazbek group, Devdorak, which has occasionally obstructed the military road between Tiflis and Vladikavkas, and on the last occasion in 1832 dammed up the Terek completely for about seven hours. M. Pastukhof has examined the glaciers of Ararat and Alagos (*S.G.M.*, vol. xii. pp. 472 and 94), as also those of the Shakh-dagh (see *S.G.M.*, vol. xi. pp. 67-76).

There are in the Caucasus about twenty snow-clad mountains bearing glacial streams on their flanks. The most important glaciers are on the northern gentler declivity of the main range, and here they descend also lower down into the plain. Elbrus is the king of the Caucasus, and it is natural that he should hide the largest glaciers in his folds. The area of its thirteen glaciers has been estimated at 46 sq. miles. They are described in the excellent work of Mr. Douglas W. Freshfield, *The Exploration of the Caucasus*, reviewed in vol. xiii. of this *Magazine*. The best-known of the Elbrus glaciers are Baksan and Azau. After Elbrus comes Kazbek with its eight glaciers already mentioned, Devdorak, Chach, Ortsveri, Abanot, Atgibir, Suatiss, Mnas, and Malief or Genal-don. The last was visited by some geologists on the occasion of the recent Geological Congress, and specially explored by C. Rossikof, who with M. Dinnik, among Russians, has rendered marked service to glaciology. The Malief is the largest among the Kazbek glaciers; it is 58 kilomètres (36 miles) long, and its lowest extremity is at 10,800 feet above sea-level, whereas, according to some earlier observations, Devdorak descends as low as 8540 feet above the sea. These glaciers seem to be in general retreating, and M. Rossikof has calculated that in twelve years, from 1882 to 1894, the Malief retreated 83·6 mètres, or, on an average, 7 mètres (23 feet) annually. We reproduce a beautiful view of this glacier from the official *Guide* to the excursion of the late Geological Congress.

The third most important group of glaciers has for its centre the mountain Adai-khokh (15,244 feet). One of them, Karagom, is 15·5 kilomètres (9·6 miles) long, and another, Zei, has a length of 9·6 kilomètres (6 miles). The latter has also been explored by M. Rossikof, and was visited on the occasion of the last Congress. We give some illustrations of it from the *Guide*. Its lowest extremity in the Ardon valley is at a height of only 6756 feet; it presents, as in the case of many other glaciers, a mighty front masked by a terminal moraine. According to the observations of M. Rossikof, the glacier has retreated

THE ZEI GLACIER (middle terrace).

THE ZEI GLACIER (left side).

THE ZEI GLACIER (foot).

THE GENAL-DON GLACIER.

in the last twelve to fifteen years 172 mètres (564 feet). Among the other mountains on the north side of the Caucasus, bearing more or less considerable glaciers, may be mentioned the Shakh-dagh, with its eight glaciers alluded to in vol. xi. p. 73 of the *Magazine*; Fytnargin with the Agashtan glacier, 6 miles long; Dykh-tau (17,054 feet) with Bezinghi, 12 miles, and Dykh-su; the Bzhedukh, having four known glaciers, on both sides of the main ridge, among them the Lekzyr, 8 miles long, with the lowest extremity at 5777 feet; the Aldyr-tau with Bashil glacier; the Tikhtengen with the Kulak and Shaur-tu.

The principal glaciers on the southern side of the range descend into the valley of the Ingur, described in vol. xi. of the *Magazine* (Svanetia). Besides Tetnult, Adish, Ghistola, Uzhba, and Gwalda towering high above the Ingur valley and sending it their glacial streams, there are on this side to be mentioned the Shkhara and Ozenghi. From Shkhara glaciers descend on both sides of the main range. Ozenghi bears the glacier Kiuish, $5\frac{1}{4}$ miles long.

We have no idea of the total number of Caucasian glaciers; it may perhaps be less than that given by Sir John Lubbock for Switzerland (from 1500 to 2000, with an area of 3500 square kilomètres—1350 square miles), but certainly there remains in the Caucasus a very vast field of glaciers to explore.

Outside the Caucasus proper there are in the country under consideration small glaciers on Ararat (St. Jacob) and Alagos.

Watersheds.—To describe watersheds is to sketch the orography. We will present only an outline of the principal ranges separating the rivers of the Caucasus into five principal river basins. There are three more or less parallel longitudinal chains, the Caucasus, the Minor Caucasus, and the Agri-dagh, cut transversely by ranges following, in the main, a meridional direction. The parallel ranges constitute three zones widely differing in climatic conditions; while the meridional ranges, but slightly elevated in the north and more imposing in the south, separate the basins of the two seas, intercept the moist western winds and thus mark off a dry, from a well-watered, country. The two opposing directions cross in the Central Caucasus at 42° E. lat., and form a high central region, a kind of dome, whence the streams radiate to all the quarters of the compass.

Central Caucasus.—It is this central vast eminence which is for the Caucasus what, on a smaller scale, the St. Gothard is for the Swiss Alps, that shall occupy us the first. It was the first land to emerge gradually from the sea, probably at the Cambrian era, and to separate the great eastern and western oceans of that epoch. It was also the first to be eroded and washed away by streams, which began to transport the material for the formation of the plains. It consists of a crystalline nucleus, metamorphic rocks and schists, some ancient and more recent volcanic products, and at both margins of some sedimentary Jurassic, Cretaceous, Eocene, and Miocene rocks. This central eminence, comprising the highest Caucasian summits, mentioned already in the pages of the *Magazine* (see vol. vi. p. 318, vol. ix. p. 256, vol. viii. p. 216, vol. xi. p. 273, vol. xii. p. 458, vol. xiii. pp. 33 and 261), consists of many

parallel ranges, of which the main chain and the "Lateral" are the most important. The last is a true axis of elevation reduced to a secondary position by the geological action of water. The two are connected by seven transversal ridges or spurs, forming as many cirques or caldrons, probably lakes in former times, where the head streams descending on the north side run in longitudinal valleys until they escape by some transversal gorge. From west to east these cirques bear the names of the Nardon, Terek, Assi, Argun, Tushi, Didon, and Ankral caldrons. The main chain is very sinuous, forming in this part, from Ulu-kol to Gudaur, two curves concave towards the north and one in the middle open towards the south; it is profoundly sculptured by the head-waters of rivers on both slopes. Here take their origin and run in all directions the principal affluents of the Terek, viz., Malka, Baksan, Cheghem, Cherek, Urukh, and Ardon on the north, the Kodor, Rion, Tskhenis-tskhali on the south, the head-waters of the Kuban on the north-east, and of the Aragva on the south-east.

There is some analogy between this arrangement and the direction of the waters in the Alps, where the St. Gothard constitutes the central eminence whence the Rhone and the Rhine, the Aar and the Ticino part in four directions at right angles to one another—SW. by NE. and NW. by SE.—as in the Caucasus, the difference being, that, while the former main direction of Swiss rivers—SW. by NE.—is the direction of longitudinal valleys and the other that of transversal valleys, in the Caucasus it is the reverse. The Rion and Terek, running in transversal valleys follow the direction SW. by NE., whilst the Liakhva and Kuban follow the main longitudinal folds.

Western and Eastern Caucasus.—The central part of the Caucasus has a length of about 264 miles, its western prolongation is of the same length, whilst the eastern part of the chain (from Barbalo to Gudur-dagh) is 363 miles. The Western Caucasus, from the Marukh pass to Anapa, constitutes an interrupted range whose eight long sections are connected with one another by short links and disposed in a manner somewhat resembling the dentated edge of a gigantic saw. Three of the most northern branches are known as the Semissam, Markotkh, and Ketsegur ranges; the other four have no distinct names. They divide the tributaries of the Kuban from the streams running into the Black Sea, of which the most noteworthy are Ghelenjik, Aderby, Pshada, Vulan, Shapsukho, Nechepusko, Nebughi, Tuapse, Psezuape, Shakhe, Sochi, Mzymta, and Bzyb. From this saw-like range detach themselves some parallel ranges and numerous perpendicular offshoots, constituting secondary watersheds. The whole mountain system, called by some the Black Sea Caucasus, containing summits of 6000 and passes 1640 feet above sea-level, is exceedingly intricate and difficult of access. The principal watershed follows a sinuous course; the rivers Psekups, Afips, Abina running into the Kuban have caused the axis to deviate southwards, whereas the Tuapse, Shapsukho, Pshada, and others have forced it northwards.

The eastern prolongation of the Central Caucasus maintains as far as Gudur-dagh, for about 100 miles, a mean elevation of about 10,000 feet; it separates the basin of the Sulak from the numerous feeders of the

Alazan, a tributary of the Kura. From Gudur-dagh to Baba-dagh, for another 100 miles south-east, the main chain comprises some summits —Baul, Malkamut, Bazar-diuzi, Tfan—rising up to 13,700 and even 14,700 feet of altitude, and divides the Samur basin from that of the Kura. From Baba-dagh to the end, the main chain, considerably reduced, runs in an almost waterless country.

The main range thus divides the country under consideration into two almost equal parts: the North Caucasus, 89,615, and Transcaucasia, 94,308 square miles.

The Minor Caucasus.—This broad range, far lower in altitude but of older origin than the main chain, runs generally parallel to it; but some of its parts strike out directions of their own at variance with the rest. It is a train of double and triple ranges connected by cross ridges, running from the cape of Tsikhisdziri on the Black Sea to the Karabakh and Bergushet on the east, where by the Salavat and Talysh it is connected with Elbrus. Its total length is about 400 miles, and it may be divided into a western and an eastern branch. The first is composed of the mountain groups known under the names of Ajar, Akhaltsikh, and Trialety (ancient Meskhi); the eastern branch bifurcates near Tiflis, and, gradually widening, makes room for a third more elevated range in its midst. The most northern range delimitating the Kura basin is composed of Somkhet, Murgus, Ganzhi, and Karabakh; the most southern, on the limits of Aras basin, is a succession of ranges known as Mokry ("wet"), Miskhan, Akmangan, and Paltapin. The four cross ridges between the two, connecting them and forming cirques, are from north-west to south-east the following—Bezobdal, Pambak, Shakh-dagh, Gokcha. The last two, with Ganzhi and Akmangan, encircle the lake of Gokcha. On the south-eastern side of Gokcha, from the cross range of the same name, the range of Zanghezur branches off, the highest in the series, though without importance as a watershed. Its altitude on the left bank of the Aras is above 10,000 feet; it sends off on both sides at right angles the ranges of Daralagoz and Bergushet. The interval between Zanghezur and Karabakh forms the high table-land of Karabakh studded with extinct volcanoes and giving origin to streams running into the Kura and Aras.

The trend of these ranges is at variance with the direction of streams, which often cross them. The geological action of water seems here to have been of greater duration and intensity than in the Caucasus proper.

The Minor Caucasus has but slight importance as a watershed, but it increases the velocity and modifies the flow of streams.

It consists partly of granitic, dioritic, and porphyric rocks, but mostly of rocks of more recent volcanic origin—trachyte, basalt, obsidian, pumice, tufa. The first crop out along the crest of Meskhi, Somkhet, Ganzhi, Zanghezur, Bezobdal, and Pambak; the second extend themselves over the high table-lands, in the Mokry and the southern half of the Miskhan ranges, and cover with deep layers the Akmangan and the western part of the Gokcha mountains. The most ancient deposits are Devonian rocks, which appear in the Paltapin and Zanghezur ranges. Later Jurassic are known to crop out on the southern slope of Ganzhi and Bergushet, whilst the Cretaceous are largely represented

almost everywhere. In the Zanghezur they form the dark imposing defile of Migri. They are mostly fissured, and their fissures are often filled up by trachytic masses, indicating extensive volcanic action posterior to the Cretaceous age, and indeed in post-Tertiary time. Extinct volcanoes are numerous in the Akmangan, Karabakh, Mokry, and other ranges.

The Agri-dagh (anc. *Argaeus*).—This range separates the basins of the Black Sea and Caspian from that of the Persian Gulf, and constitutes the eastern prolongation of the Palanteken range. It follows the 40th parallel of N. lat. from the Kessa-dagh (11,262 feet) on the west, and Ararat (16,916 feet) on the east, a distance of about 100 miles, with a mean breadth of from 20 to 40 miles. Its mean altitude is about 8000 feet, and its ridge is generally sharp. It constitutes the political frontier between Turkey and Russia. In its western part it descends very abruptly towards the Aras, but in its eastern part the slope towards this river becomes far gentler and it is intersected by some small streams, usually dry in summer. The range is woodless and poor in water, craggy and fissured, presenting wild scenery. In post-Tertiary times volcanic energy was powerfully developed in this region, as extinct volcanoes such as Kessa-dagh and Ararat strikingly testify. Diorite, diabase, and porphyry crop out in the middle part of the chain, between Kulp and Kaghyzman. Devonian mountain limestone has been observed at the southern base of Ararat (*S.G.M.*, vol. xii. p. 94).

Transverse Watershed.—This does not constitute a true uninterrupted range, but consists of secondary mediocre and even small ranges, running between the high longitudinal chains we have just described. It exercises, however, a very great influence not only on the hydrography but also on the climate of the country under consideration. It is a line of demarcation between the western well-watered and the dry eastern, partly desert, region, which is the threshold of one of the driest regions on our globe. Interrupted as it is by the parallel chains of mountains above described, it consists of three sections: the northern table-land of Stavropol and Sadyrlar, the middle Suram range, and the southern Arsian. The western region thus marked off embraces an area of about 70,559 square miles, the eastern 112,364 square miles.

The northern transverse watershed follows long. 42° E.; it is scarcely distinguishable north of lat. 44°, where the Yegorlyk seems to hesitate between the Black Sea and Caspian routes. Farther south it becomes pronounced, where it expands into the Stavropol table-land at an altitude of 300 mètres (1600 feet), rises to 11,000 mètres at the Sadyrlar, and merges finally with the snowclad colossus of Elbrus. The Stavropol highlands emerged from the sea in Pliocene times, when the Caspian was definitively separated from the Black Sea and converted into dry land. The middle part of the transverse watershed begins at Mount Zikari, long. 42° E.; it follows the Racha and Suram-Meskhi ranges, thus connecting the main chain with the Minor Caucasus. Two parallel ranges appear to extend their arms to one another, for the Suram consists of two branches running in opposite directions, the one from Racha southwards, the other from Meskhi northwards, and meeting at

the Suram pass, 3927 feet, the lowest point of the range, traversed by a railway. The Suram range emerged from the sea in Jurassic times; it has an igneous nucleus (granite and porphyry) covered by Jurassic and Cretaceous strata (especially the Dogger in which coal has been found). The most southern transverse watershed, connecting the Minor Caucasus with the Agri-dagh, consists of two ranges, succeeding one another, the Arsian and Soganluk. The Arsian detaches itself from the Meskhi in long. 42° 20′, at Chubukh-naryn-bashi, separating the Ajara, tributary of the Chorokh, from the Koblian, an affluent of the Kur. For 66 miles it runs southward as far as the Khorosan mountain, bends south-eastwards and then southwards to Kumry, and finally turns westwards into Turkey, where it is known under the name of Dumli or Dersimli-dagh. Its total length within the limits of Transcaucasia is 130 miles, and its mean altitude from 7000 to 10,000 feet. Northwards the sharp crest of the range gradually expands, and at the Yalanus-cham pass is already 4 miles broad. Its eastern, rather gentle, slope rests upon the Akhal-kalaki table-land, whereas the western, abrupt, slope descends lower into the Imer-khevi and Chorokh valleys. For half the year it is covered with snow.

The Soganluk range, separating farther south the waters of the Aras from those of the Chorokh, is considered an offshoot of the Arsian mountains; it is a kind of table-land, 26 miles long and 20 miles broad, accessible on all sides and overlooked by a few summits, the highest of which is Surpkhach, 9495 feet, on the left bank of the Aras.

The Arsian mountains are partly crystalline; on their eastern slope crop out trachytic and basaltic rocks, and they show many traces of volcanic activity which here took place in post-Tertiary times. The flanks of these hills are covered by Cretaceous deposits.

These mountains unite the Minor Caucasus to the Agri-dagh, which is the eastern prolongation of the Palanteken range. On the south of it there is high ground, a mountain knot, rich in lakes and springs, where the sources of the Aras and Euphrates (Murad-chai) are situated. It is called Bin-gol-dagh.

Principal Rivers and Lakes.—The main chain of the Caucasus, and the transverse watershed just described, divide the drainage into four principal river basins: those of the Kuban (anc. Gipanis) and Rion (anc. Phasis) in the western, and those of the Terek (anc. Lomakhi) and Kura (anc. Kyros) in the eastern part of the country. There are besides six rivers of some importance, viz., the Kagalnik, Eia (anc. Romvit), Bzyb, Kodor, Ingur, and Chorokh (anc. Phison or Apsaros) in the west, and five others, viz., the Kuma, Manych, Sulak, Samur, and Lenkoran, in the eastern region, forming together eleven secondary basins. The Kagalnik, Yeia, Kuma, and Manych are true steppe rivers, losing themselves from evaporation in extensive tracts of about 45,000 square miles of treeless and partly desert pasture grounds, where Kalmyks, Kara-nogai, and other nomads tend their flocks. All these rivers do not properly drain the country, for in their lower course they form numerous pools and stagnant lagoons.

The southern half of the Northern Caucasus is well drained by the

Terek and Kuban, having respectively drainage areas of 23,085 and 21,268 square miles. In Transcaucasia, on the eastern coast of the Black Sea, there are, between the Strait of Kertch and Pitsunda, a great number of small rivers which reach the sea—Pshada, Shapsukho, Tuapse, Ashe, Psezuape, Shakhe, Sochi, Mzymta, and Psou—with a total drainage area of about 6455 square miles. More to the south, somewhat larger rivers enter the sea—the Bzyb, Kodor, and Ingur, with a total drainage area of 6504 square miles. There remain in the Black Sea basin the two largest rivers, the Rion and Chorokh, with respective areas of about 7120 and 10,500 square miles. About three-quarters of the Chorokh basin appertains to Turkey. In eastern Transcaucasia the joint rivers Kura and Aras drain 77 per cent. of the total area, viz., about 56,000 square miles. There are besides the Sulak, Samur, Kurakh-chai, Sumgait (Jengi) draining the northern slope of the main chain into the Caspian, the Vilazh and Lenkoran, bringing their waters into the same sea from the flanks of the Talysh range, and the Bolgaru, which loses itself in the Makhmud-chala. The drainage area of the Sulak is above 7000 square miles, and that of the Samur 4254 square miles.

Many of the Caucasian rivers roll their turbid waters down once famous valleys, which have still preserved, in popular language, their old ethnographical or historical names. Thus the upper valleys of the Kuban and Teberda are called Karachai, those of the Chegem, Urvan, and Cherek, affluents of the Terek, are known respectively as the Chegem, Bezinghi, and Balkar countries. The upper valley of the Iora and Alazan in the Kura basin is called Kakhetia, the valleys of the Assa and Argun, tributaries of the Kura, Khevsuria and Pshavia; that of the Andikoissu, affluent of the Sulak, Tushetia; that of the Avar-koissu, Koisubu; the lower valley of the Kara-koissu is called Andalial. A considerable part of the Kura valley, between Borzhom and Mtskhet, is known as Kartalinia; the upper valley of the Khram, its tributary, as Borchala; the higher valley of the Western Arpa-chai is called Shuragel; the upper valley of the Rion, Racha; those of the Ingur and Chorokh, as was explained in vol. iii. and xi. of the *Magazine*, are known as Svanetia and Zemo-kartli.

Lakes and Pools.—That lakes are absent from the Caucasus, as Mr. W. Freshfield states in his *Exploration of the Caucasus* (*S.G.M.*, vol. xiii. p. 32) is in general true. There are, indeed, a few such as the Kell, Forel, Amkachi, but these are rather pools, and certainly they do not constitute an important element in the scenery as in Switzerland. The lakes have probably disappeared. There are some important lakes, however, in the Minor Caucasus, on the Akhalkalaki table-land, on the high ground of Bin-gol ("thousand lakes"), as also in the low plains near estuaries and sea shores. Here are the most noteworthy of the mountain lakes:

	Area.	Height of Surface above Sea-Level.
Gok-cha, . . .	528 square miles.	6340 feet.
Chaldyr, . . .	33 „	6522 „
Toporovan, . . .	14 „	6500 „
Tabis-tskhuri, . .	6·5 „	6669 „
Khozapin-gol, . .	10 „	6851 „

Besides others, as Khanchaly, Madatapa, Tuman-gol, and Aigher-gol, about which we have no positive data.

Among the lowland lakes, the most noteworthy are the Paleostom (seven square miles) on the left bank of the Rion near the sea; Pitsunda, near the estuary of the Bzyb; Makhmud-chala, Akh-sybir, Kaladagnia, on the Caspian. There are besides, in many places near the sea of Azof, Black Sea, and Caspian, more or less large lagoons called "chala," when shut off from the sea, and "mortsy" or "liman" when connected with it.

Gok-cha, by far the most important of Caucasian lakes, receives about sixteen tributaries, and has only one emissary, the Zanga; it abounds in fish, but has a desolate and lonely aspect, though not without grandeur in a storm.

Discharge of Rivers.—The relation of evaporation to rainfall and river-discharge is a very interesting, and as yet not sufficiently elucidated, question. What part of the total rainfall is run off to the sea in the Caucasus, or, in other words, what is the ratio of drainage to rainfall? We will try to answer the question as far as our materials admit. In Great Britain not more than one-fourth of the total moisture deposited on the land from the atmosphere is carried out to sea by streams. We may expect something more than this proportion in the Caucasus.

We have estimated the area drained by the Kuban at 21,268 square miles, or 55,086 square kilomètres. The mean annual rainfall in the Kuban region, a mountainous country and limited on the north by the right lofty bank of the river, receiving from this side no tributaries, may be from 600 to 650 mm. (23½ to 25½ inches). This gives annually a volume of water from 33 to 35·8 cubic kilomètres (7·9 to 8·6 cubic miles). The average discharge of the Kuban has been calculated at 556·20 cubic mètres per second, or at 17·5 cubic kilomètres (4·2 square miles) per annum. Therefore one-half of the total rainfall runs off to the sea. This is not surprising, as all the affluents and the river itself have a very considerable velocity.

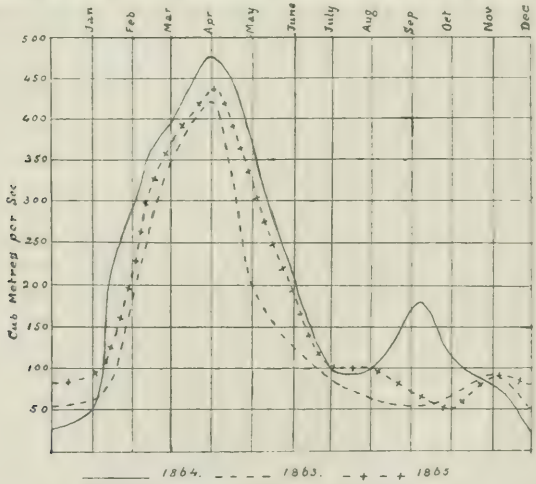
The Kura was studied with particular care by the late Messrs. Belly and Gabb in the years 1862-65. The average discharge of this river is taken to be equal to 571 cubic mètres per second, or 18 cubic kilomètres per annum, but according to later estimates it is as much as 19·72 cubic kilomètres (4·7 cubic miles). The whole area of the Kura basin, only a part of which is within the Russian empire, is estimated at 226,000 square kilomètres (87,250 square miles); it is in general a dry region, the mean annual rainfall varying from 778 (30½ inches) (Ardagan) to 158 mm. (6 inches) (Aralykh); for the whole basin it cannot be much more than 300 mm. That gives a total annual volume of water of 67·8 cubic kilomètres (16¼ cubic miles), rather more than one-fourth of which, 27 per cent. to 29 per cent., is carried off to the sea.

The Kuban basin may well serve as example for the whole Black Sea littoral, the ratio of drainage to rainfall over the area of about 43,000 square kilomètres (16,600 square miles) being as much as one half; whereas the Kura region approaches more to the conditions prevailing in the northern Caucasian steppes. Both eastern regions return

to the sea a smaller part of the rainfall than their western counterparts.[1] The evaporation is very intense (up to 1½ mètre per annum) in the lower part of the Kura, and a considerable quantity of water is expended in artificial irrigation; whilst in the Nogai and Kalmyk steppes the streams are sluggish and sink in the sands. In the Terek basin, where the streams are very rapid, the ratio of drainage to rainfall is a little below that of the Kuban region. The area of this river basin is 59,100 square kilomètres (22,800 square miles); the mean average annual rainfall not above 500 mm. (19½ inches), the total volume of water received 29·5 cubic kilomètres (7 cubic miles), and the annual discharge of the river 12 cubic kilomètres, or 40 per cent. of the whole.

The Rion, running in a well-watered country, where no artificial irrigation is needed, is the least investigated of the more important Caucasian rivers. Our numbers concerning its basin are but approximative. The area of its catchment basin is about 18,250 square kilomètres (7000 square miles); it receives annually, at least, 1500 mm. (59 inches) of rainfall equally distributed, or a total volume of water of about 27 cubic kilomètres (6½ cubic miles); the average discharge of the Rion may be from 450 to 500 cubic mètres per second, or from 14·2 to 15·8 cubic kilomètres per annum, or from 53 per cent. to 58 per cent. of the total rainfall.

Leaving out of account the vast northern steppes, where scarcely any water is returned to the sea, and considering only the basins of the four principal rivers, the Kuban, Terek, Rion, and Kura, draining an area of



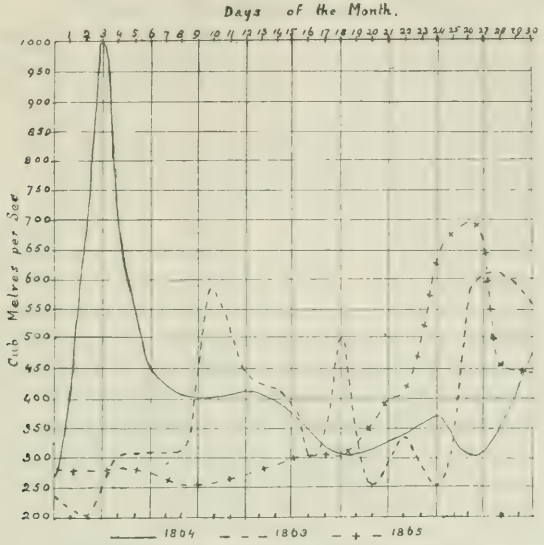
Monthly discharge of the Kura near Tiflis.

358,436 square kilomètres (138,389 square miles), and having a total annual discharge of about 65·5 cubic kilomètres (15·7 cubic miles), we may calculate that the ratio of drainage is 61 : 161, or 38 per cent. for the whole area, inclusive of the Persian part of the Kura basin, and 48

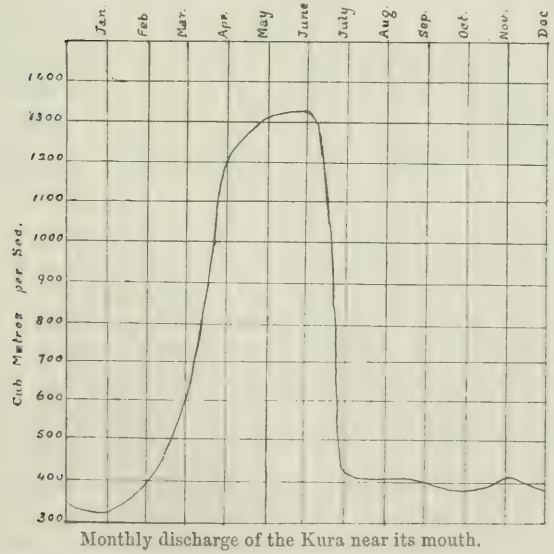
[1] As the area of the Caspian is 165,175 sq. miles, and the discharge of all the rivers that enter it 174·5 cub. miles, the surface, which now stands 83·7 feet below that of the Black Sea, would be raised fully 5½ feet annually, were there no evaporation: as it is, the level tends to fall.

per cent. to 50 per cent., if we consider only the area drained by the three first mentioned, properly Caucasian, rivers.

The discharge of rivers is very unequal in different seasons, and from year to year, depending on the melting of the snow and rainfall.



Daily discharge of the Kura near Tiflis in April.



Monthly discharge of the Kura near its mouth.

The extremes recorded are, for the

Kuban,	from	269	to	2640	cub. m. in a second.	Mean 556	cub. m. per second.
Terek,	,,	157	,,	1257	,, ,,	,, 320	,,
Rion,	,,	270	,,	1400	,, ,,	,, 450-500	,,
Kura,	,,	380	,,	1500	,, ,,	,, 571-625·5	,,

The real difference, or the ratio between the minimum and maximum discharge, must certainly be yet more considerable. It is known that the amount carried off in floods varies from 1 to 100 cubic feet per minute per acre.

The greatest discharge is in April, May, and June; the least in December and January. There is a great number of streams which dry up or are completely exhausted by irrigation in the summer. The discharge is more equal in the rivers fed by glaciers, in those appertaining to the basin of the Black Sea.

We reproduce here a graphic representation of the variation in discharge observed by Messrs. Belly and Gabb on the Kura.

Flow.—Regarding the flow a distinction is usually made between mountain, valley, and plain sections of rivers, and in our case we may appropriately distinguish also between rivers running on high table-lands and those of sandy steppes. True mountain rivers, such as the Rion, Kuban, Terek, and Aragva, and most of their affluents, rise amidst the clouds and snows, are fed by glaciers and numerous torrents, dash rapidly down, leaping from crag to crag, and bury themselves in narrow and profound gorges, growing every moment in volume and breaking by their incessant roar the solemn silence of these high altitudes. Valley rivers, according to the geological nature of the ground they traverse, assume varied aspects. In the longitudinal valleys traversed by the Kuban and Kura in their middle course the mountains leave extensive level areas for cultivation, their slopes are gentle, covered with grass and bushes, and often descend in terraces. Here the rivers receive their largest tributaries. In transverse valleys, such as those traversed by the Terek, Malka, Ardon, Rion, Kvirila, Laba, and many others, the rocky walls limiting them remain still abrupt and precipitous, and they show clearly the disposition of the folded strata, but the violence of the flow is diminished, the ranges in the vicinity become lower and farther apart, their ridges lose their sharpness and become flat. High plateau rivers, such as the Aras, Chorokh, and Arpa-chai, have a moderate velocity, descending slowly from one terrace to another over low banks. At high water in the spring they are subject to great floods and form swamps, marshes, and morasses, not completely returning to their beds in summer. Their flow is accelerated only at the passage from one terrace to a lower one, and then they burrow out deep ravines with steep banks. Steppe rivers—Yeia (anc. Romovit), Beissuk, Kirpili, Kuma, Yegorlyk, and others—rise in springs situated at a low level above the sea; they run at first in deep dells and ravines, with gently sloping grassy banks, but on approaching their middle course they expand, scarcely confined by their low banks, and at last, as the rivers approach their goal, these banks diverge so as to leave room for large estuaries (limans) which extend for miles from the sea or the place where the river disappears in the sands. Rapid at high waters in spring-time, these rivers are almost stagnant in summer, when they are choked up by weeds, reeds, and other marshy vegetation.

Only very few Caucasian rivers assume the aspect of true plain rivers. The Kura, some 160 miles before reaching the sea, the Terek and Rion for some 100 miles in their lower courses, become sluggish, meander-

ing in wide curves, dividing into numerous branches and passing out into the sea through mud, sand, and morasses.

Slope.—Rising from springs and glaciers at an altitude from 8000 to 9000 feet and more, a number of Caucasian rivers, including all the tributaries of the Terek, Kuban, and Rion, precipitate themselves impetuously downwards, and in a furious course of some 60 to 70 miles attain the plain only just above the level of the sea. Thus the average slope is from 110 to 150 feet per mile. The Ardon, an affluent of the Terek, the "mad river" as its name signifies, is formed by the union of the Manisson-don and Nar-don at a height of 9279 feet, and falls into the Terek after a run of 65 miles, thus falling about 140 feet per mile, or 26 in 1000. The Mzymta rises at an altitude of 10,000 feet and reaches the Black Sea in a course of only 52 miles, thus descending at a rate of 192 feet per mile. The Bzyb falls from its source 12,000 feet in 66 miles, or at a rate of 181 feet per mile. Such rivers, and they are numerous on the eastern shore of Black Sea, are really ungovernable, or at least they are considered to be so, and they render the beautiful region they traverse very difficult of access. The average slopes of the mountainous parts of the Chorokh (Zhorok), Rion, Terek, and Kuban have been calculated as respectively 30, 42, 85, and 57 feet per mile. The slope of the Kur varies from 35 to 0·9 feet per mile.

SLOPE IN 10,000.

	MAX.	MIN.	MEAN.
Kura, ...	66	1·7	20
Aras, ...	90	6	36
Kuban, ...	114	7	36
Terek, ...	130	9	51
Rion, ...	130	9·5	87

Velocity.—This is in direct ratio to the slope and inverse ratio to the transverse section of the bed, and is determined by the formula:—

$$V = 50\sqrt{Ri}$$

where i indicates the slope and R the ratio of the section to the wetted perimeter. According to this formula, a current in a given section which has a velocity of 0·9 mètre per second with a slope of 0·0003, will acquire a velocity of 2·85 mètres per second if the slope be increased tenfold, and a velocity of 9 mètres per second if the slope be increased a hundredfold. The former slope is that of many Caucasian streams in the plain region, and their velocity is in fact equal to 3240 mètres, or 2 miles an hour. Such are the Kuban, Terek, and Kura, where they run through alluvial plains; some of the streams, as, for instance, the Nakhichevan-chai, have even in the plain a velocity of 3½ miles an hour. Most of the Caucasian rivers in their valley reaches have a slope of 16 to 34 feet per mile (from 0·003 to 0·006), and their velocity is consequently from 9·44 to 11·48 feet per second, or from 6·4 to 7·8 miles per hour. The velocity of the Kuban, Terek, Rion, and their affluents in the mountain section is about 20 miles per hour.

Independently of occasional floods after heavy rains, most of the

Caucasian streams are more or less regularly flooded thrice a year; early and late in spring and late in the autumn. It is very seldom that the velocity of a current is increased threefold by a flood, for it can only be in consequence of a tenfold increase in the depth of water.

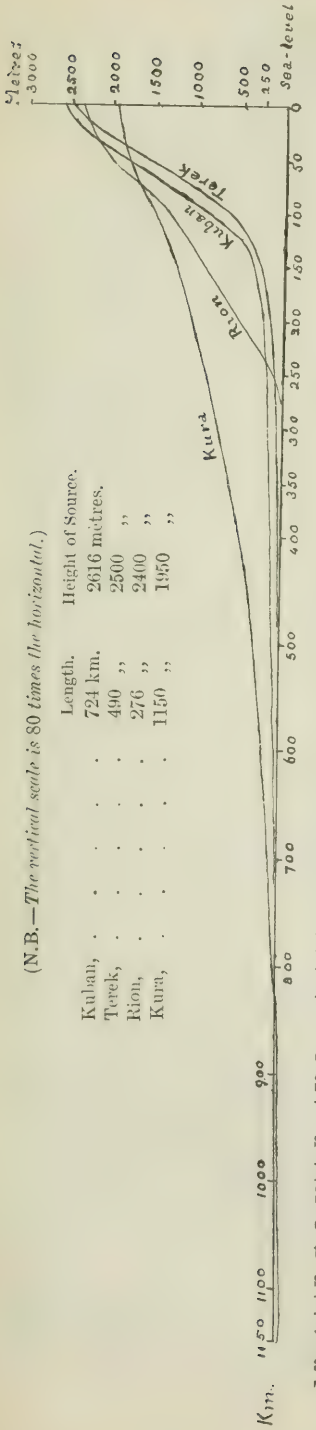
Direction.—The direction of streams is to be considered in their mutual relations, in reference to the points of the compass, and in relation to the geological strata. The changes in direction should also be noticed. Most streams in the Caucasus have a meandering and even tortuous course, and they mostly attain their estuaries by a circuitous route. The following figures show the real lengths of some rivers and the shortest distances between their sources and their mouths:—

Kuban,	total length	450 miles;	distance as the crow flies between source and mouth,			280 m.
Terek,	,,	300 ,,	,,	,,	,,	170 m.
Rion,	,,	170 ,,	,,	,,	,,	100 m.
Kura,	,,	710 ,,	,,	,,	,,	380 m.

These figures do not give a complete idea of the sinuosity of the rivers, the lengths being only approximate. In the case of some rivers, the length, including all the sinuosities, is more than double the length of a line following the general direction. The sinuosities are greatest in the plain sections of the Kura and Terek. From Minghechaur to the estuary the Kura makes large bends and curves. In flood the old bends are sometimes abandoned, the river bursts into new channels, and at the place of abandoned meanders there remain pools, known under the name of "akhmas." Approaching the estuary, the river divaricates still more and its extreme branches part asunder to a distance of 30 to 35 miles. In the case of the Terek and Kuban the divarication goes still further, the branches of those rivers before reaching the sea spreading out to double this distance.

As to the mutual relation in the direction of streams is noteworthy in the Caucasus the prevalence of binary hydrographic systems. There are many paired or twin rivers, such as the Kura and Aras, the Iora and Alazan, the Rion and Kvirila, the Terek and Malka, the Kuban and Laba, the Great and Little Laba, the Bielaia and Pshekha, the Ullukan and Uchkulan, the Yeia and Kugu-Yeia, the Beissuk and Beissuzhok, and others. In each case the twin rivers rise in close proximity, separate widely in their middle courses—in the case of the Kur and Aras about 150 miles—and join at the mouth; in each pair both rivers are of nearly equal importance.

Another point in the direction of rivers to be noticed is their parallelism. Thus all the tributaries of the Kura from the Akstafa to the Ganzha, as also the left tributaries of the Aras from the Zanga to the Ghilan, and most of the affluents of the Sunzha and Kuban run parallel to one another. This indicates a continuity of the slopes down which these rivers flow. A further peculiarity in the hydrographic system of the Caucasus is the one-sidedness in the distribution of the affluents. The plain of some of the principal rivers, such as the Terek, Kuban, Alazan, and part of the Kura, with their affluents, resembles a tree allowed to grow only on one side. It is the proximity of watersheds, running along near



(N.B.—*The vertical scale is 80 times the horizontal.*)

	Length.	Height of Source.
Kuban, ...	724 km.	2616 metres.
Terek, ...	490 ,,	2500 ,,
Rion, ...	276 ,,	2400 ,,
Kura, ...	1150 ,,	1950 ,,

one of the banks of the river that has prevented a more regular arrangement of drainage channels. As to the direction of rivers in regard to points of the compass we have already noted a certain analogy between the Caucasus and Switzerland. Descending from a central eminence in both cases they follow two main directions at right angles to one another, NW. by SE., which in the Caucasus is the trend of the mountains, and SW. by NE., which is at right angles to the axis of elevation.

The principal Caucasian rivers change their direction at their descent into plains, as, for instance, the Terek, which from its confluence with the Malka takes the direction of the latter, turning abruptly from NW. to E. The Rion, on passing Kutais, turns also suddenly from a southward to a westward direction. In both cases the principal rivers have probably taken possession of beds of more ancient and more direct streams; just as the Rhone at Martigny turns northward, following the bed prepared by the Dranse. The Kuban past Nevinomysk turns from N. to W., thrust out of its course by the Stavropol hills, or may be, as Mr. Apostolof more poetically explains it, shunning the fate of its neighbour, the Kuma, which loses itself in the sand. Such sharp turns in the course of a stream, called by Prof. Davis "elbows of capture," are usually due to the action of streams posterior to those the directions of which are thus changed.

There have certainly been in past time changes in the directions of the rivers. Some rivers may have eaten their way back and so tapped the beds of other streams and captured their waters, as was probably the case with the Terek and Sunzha. We have seen that the "Lateral" chain is the original axis of elevation in the Caucasus, as shown by its fan-like section on the military route between Lars and Kazbek, and therefore was the watershed between the rivers flowing north and south of it. Such is not the case now. The northern streams, Terek, Ardon, and

others, have eaten, we may suppose, their way back, abraded the highest ridge, pushed the watershed southward, tapped the valleys on the opposite side, diverted a part of their drainage, and gradually reduced the former watershed to such a degree that now its altitude is some 1000 mètres below the pass of the Cross, thirteen miles to the south. Probably other agents have also contributed to this result.

As to the direction of rivers in relation to the strata we may observe that here, as in the Alps, some rivers cut through mountain ranges. Thus the Rion traverses the range of Adai-khokh at right angles to the trend. The Tskhenis-tskhali runs across Svanetia; the Chorokh traverses the Pontine range; the Kura cuts through the ranges of Ugurli, Meskhi and Trialet; the Khram traverses the Somkhet range; the Terter that of Karabakh; the Aras runs across the Agri-dagh and Migri; the Terek, Ardon, Urukh, Aragva, and many others traverse at right angles the main chain. Some important rivers on the other side, and among them the Kura and Aras, the Kuban, Iora, and Alazan, follow in the main the strike of the strata. They are eminently strike streams, as opposed to dip and anti-dip streams running counter to the trend of the mountains.

The Caucasus being a folded range, the question arises whether its streams run for the most part in anticlinal or synclinal beds, the former, as is known, greatly favouring the action of erosion. Naturally the drainage of a chain folded in geologically recent time, late Eocene and even Miocene, and itself a great anticlinal, must principally be affected along anticlinal ridges. And we see, indeed, a number of rivers, the Rion, Kvirila, Tskhenis-tskhali, Cheshura, Buja, Ingur, Malka, and others running mostly in anticlinal valleys.

Mr. W. M. Davis (*Geog. Jour.*, vol. v. No. 2) would have us also distinguish between consequent streams, running straight to the constructional shore-line; subsequent, running perpendicularly to the former; and obsequent, the latest in succession, swelling the subsequent streams in the direction opposite to the consequent. The study of Caucasian drainage is not sufficiently advanced to allow such distinctions to be made, and all we can observe on this head is that very few instances have been noticed in this country of obsequent streams. This distinction coincides with the one just mentioned between streams running along the strike or across it—strike, dip, and anti-dip streams.[1] The direction of streams may favour their formation into river systems or, on the contrary, allow them to pursue their courses independently without combining into large basins. The event is determined by the age of the streams, the distance from sea, and the character of the rocks. Perhaps there are in the Caucasus so few obsequent or anti-dip streams, because the mountains being relatively recent, river systems have not had time to develop. There is a number of rivers pursuing their way to the sea independently, and there is but one river system completed, that of the Kura, the other three, where the principal river receives its tributaries only from one side, being truncated.

[1] This subject has been well treated by Mr. S. S. Buckman in his paper, "The Development of Rivers"; and particularly the Genesis of the Severn (*Natural Science*, April, 1899).

Geological Action of Rivers.—This action is mainly mechanical, but the chemical action cannot be entirely left out of account. The solid matter in Caucasian streams has been calculated to be from 20 to 47 parts in 100,000. The water of the Kura holds in solution mineral matter in the proportion of 20·9 parts in 100,000, of which calcium carbonate constitutes about one half. Taking the Kura water as standard, we should have in the whole annual discharge of Caucasian streams (65 cubic kilomètres, or 15·5 cubic miles), about 13½ million cubic mètres (477 million cubic feet) of mineral matter in solution, or about 25 million tons. There is, however, considerable variation in the proportion, as also in the composition, of the matter dissolved in Caucasian streams. Thus in the brook Avchala, which furnishes the Tiflis with its water, the proportion of dissolved minerals is more than double, and their principal constituents are carbonate of lime and sulphate of soda. This latter salt is often found in Caucasian rivers, which are remarkable for the absence of sulphates of lime, generally abundant in European streams. Below is an analysis of the Kura water, with the number of tons of each of the designated salts in a cubic mile of water.

Calcium carbonate, . . .	420,650	tons	per cubic mile.
Magnesium carbonate, . . .	92,543	,,	,,
Potassium sulphate, . . .	27,342	,,	,,
Sodium sulphate, ...	128,298	,,	,,
Sodium carbonate, ...	22,715	,,	,,
Sodium chloride, ...	26,922	,,	,,
Silica, ...	75,296	,,	,,
Ferric oxide, Manganese oxide, Alumina, . . .	2,523	,,	,,

Streams exercise a mechanical action in erosion, transport, and deposition. The one may be, to a certain extent, measured by the other. The volume of sediment must correspond to that of the eroded soil which furnished it. This erosion goes on incessantly in the upper part of streams, while it is occasional, at the time of floods, in their middle and lower courses. Between the eroding part of the stream and its constructive part, where mud and gravel are deposited, there is a more or less lengthy track through which the hard materials in suspension are usually transported.

A stream is like a grinding-mill. Besides the general abrasion of the whole bottom over which the loose detritus is rolled, one may observe the effects of erosion in hollows and grooves, pot-holes of small and gigantic dimensions. The profound caldrons between the main chain and the "Lateral" range, formerly the main axis, have been probably produced, in the main, by the imprisoned waters of the Terek, Ardon, Urukh, Cherek, and others. The intensity of erosive action may be partly judged by the present scarcity of waterfalls in this country. Many favourable conditions for the production of waterfalls exist; various degrees of hardness of rocks, transitions from one geological formation to another, faults, dams and dykes running across the beds of rivers, and

yet, though rapids are frequent, waterfalls are rare. Like lakes, they have, it seems, disappeared, having been obliterated in the course of time. The process is well described by G. Chisholm (*S.G.M.*, vol. i. p. 416). "The obstruction of the current," he says, "where the river meets with harder rocks increases the energy of the erosion, and thus helps in overcoming the greater resistance. In those parts the channel is deepened more speedily than elsewhere. Along the channel so deepened a greater volume of water sweeps, and the erosive energy is rendered greater still."

Thus a river, after descending a cataract, flows through a narrow defile where there is no obstruction, but where only the swiftness of the current, as is very often the case with Caucasian streams, tells of the past experiences of the river. The erosive action of mountain streams, carrying in suspension a quantity of loose rocky material, is too evident to require any special demonstration, but there are in the Caucasus some very striking illustrations of it, worthy of particular notice. We allude to remarkable mud torrents, called here *sael* or *selaf*, which in their normal state have the appearance of dried-up sloughs, but burst out from time to time after heavy rains in the form of terrible avalanches of mud. The movement is always unexpected, and is wont to work terrible havoc. In the summer of 1869 the writer personally witnessed the awful destruction worked in Ordubat in a few minutes by the sudden outburst of such a selaf, which usually presented a very harmless appearance. A number of houses in Ordubat were overwhelmed, and a considerable extent of the gardens surrounding the town, on the left bank of the Aras, was overrun by an enormous quantity of mud. Such selafs are met with in the dry regions of eastern Transcaucasia, on the Aras and its tributaries. The sudden and violent outburst of the selafs (known as "nante" in the Alps) may be explained by the slipping of loose argillaceous soil into dry ravines in consequence of undermining, and the temporary damming up of the sub-soil water.

There are also many intermittent torrents of other kinds which flood the country, scattering stones and gravel and causing fearful devastation. They burst out after a heavy rain in consequence of the rapidity with which the rivers swell, the narrowness of the channel, obstructions of different kinds thrown into the bed of the stream, and also of the previous undermining action of underground water. Of such a nature are almost all the torrential streams descending from the main chain, and the destruction caused by them is especially great in the eastern regions, where rain is scarce and droughts of longer duration. In those regions all the contours of the river banks are sharper.

The transporting capacity of rivers depends on the volume and velocity of the current, size, shape, and specific gravity of the sediments. According to M. Hopkins, the capacity of transport increases as the sixth power of the velocity of the current, and thus the motive power is increased 64 times by the doubling of the velocity, 729 times by trebling it. The velocities of the Kuban and Terek in different parts of their courses are in the ratio of 1 : 2 : 5; there is therefore an increase of their transporting power, which, in following the streams upwards, would be estimated

at 1 : 64 and up to 15,625 times, if it were dependent on the velocity alone. But of course there is a corresponding decrease in the volume of water carried by the streams as we ascend towards their sources, which counterbalances the transporting power. We have seen that the velocity of Caucasian rivers varies from two up to twenty miles per hour. Ordinary sandy soil is moved by a current of only half a mile per hour; no wonder then that most Caucasian streams, except brooks and rivulets in high mountainous regions at low water, have turbid waters, and that the quantity of clay, sand, dark volcanic, and other earthy matter in suspension is so considerable that it gives them a yellow, brown, and even chocolate colour. In this respect the contrast is great with the usually clear and blue streams of the Alps, where the lakes contribute so much to the clearing of their waters. The Rhone, even above the lake of Geneva, though turbid, has a far lighter colour than the Terek, Kura, Kuban, and other Caucasian streams. It has been calculated, though certainly not with sufficient accuracy, that the principal Caucasian rivers carry in suspension from 0·015 up to 0·04 parts of earthy material by weight, which seems enormous. The most turbid waters are those of the Terek and Kura in the eastern, dry part of the country. We believe that the real proportion of the mechanically mixed constituents of these waters is about 0·002 by volume, and 0·004 by weight. This considerable turbidness may be due, besides the swiftness of rivers, to the slight consistency of the rocky materials their beds and banks are composed of, the desiccating influence of dry easterly winds, long intervals between rain and drought, the effects of frost, of stone avalanches, and perhaps also to the abruptness and narrowness of the river valleys and defiles. Considerable even at low water, the quantity of silt transported by Caucasian streams is naturally increased in floods, which are the more extensive as there are no lakes to regulate them. Accordingly the ratio of the discharges at low- and high-water mark, which for the Rhone below the lake of Geneva is 1 : 4, attains here to 1 : 10. It is not only silt which remains in suspension, but also coarser material; gravel and stones are removed from the bottom of the streams. All this hard material torn off or washed away by the streams and triturated by mutual friction serves for the formation of alluvial plains and other constructive work: at the foot of the mountains, where the torrent is checked in its velocity, at the concave side of sharp bends in the bed of the streams, in every part of the plain the river traverses, in bars and lagoons, in deltas, and in the sea. We cannot enter into much detail about the repartition of all this material brought down by streams, but will only note some traits peculiar to the country under consideration.

We observe here a gradual elevation of certain plains and valleys, particularly in eastern Transcaucasia, in consequence of artificial irrigation, which is extended over an area of more than 12,000,000 acres. As the water conducted from the rivers by irrigating canals on to the fields is always charged with a considerable quantity of silt, the ground is not only watered but also covered by fresh deposits of silt and slime, just as in the valley of the Nile. The streams deposit a part of their

earthy charge most frequently on quitting the hilly ground and entering the plain and on retiring after floods to their beds. In the former case not only the diminution of velocity, owing to the gentler slope, and the consequent dropping of a part of the sediment, but also the irrigating canals taking off from the foot of mountains, assist in raising the level of the ground by distributing the silt. At the outlets of streams into plains are often observed fan-shaped cones of boulders and shingle with their apex at the point of emergence. Many of the Caucasian streams are subject to floods. The Kuban inundates the adjoining lands to a breadth of six to eight miles; the Kura at its junction with the Aras sometimes spreads over an area of forty to forty-five miles in breadth. The lower valleys of these rivers are fringed with superimposed terraces representing former flood levels. The Terek is subject to great inundations which are but partly checked by lateral dams, constantly carried to a greater height at the expense of their solidity as the bed of the river is raised up. This elevation of the bed above the surrounding plain, as well as the raising of the banks on which the coarsest material is deposited during inundations, and which impedes the retiring waters from regaining their bed, causes the formation of numerous pools and "false beds" called *eriks* in the Kuban province and *chala* on the Kura.

On approaching the sea, the Rion forms at its estuary shifting bars, which greatly impede navigation. The Terek also forms considerable bars, which choke the Caspian. The Kuban, Terek, and Kura have built up large deltas at their mouths, which protrude considerably into the sea and form peninsulas intersected by numerous watercourses. The Kuban has built with its deposits the vast peninsula of Taman, the Kura the peninsula of Salian, and Terek a number of sandbanks of different names, which are ever reducing the area of the Caspian more and more. The silt does not all drop in the mouths of the rivers, but is carried out far into the sea. The fresh water, always charged with silt, flows out in an unimpeded stream for some time on the surface of the sea, in a direction determined principally by the conformation of the river mouth and the wind. Thus the silt is deposited on the bottom of the sea at a greater or less distance from the shore. Of the seas the Caucasian rivers fall into, only the Black Sea is large enough to easily dispose of the silt poured into it, while the two small seas—the Azof and the Caspian—are being choked up and losing more and more of their domain. The bottom of the Sea of Azof consists of the same sandy-argillaceous soil as the subsoil of the steppes surrounding it; the water is continually decreasing in depth and the area is encroached upon by sandbanks sixty to eighty miles long. The Caspian is also succumbing in its struggle for existence; at its expense have already been formed alluvial plains of many hundred square miles at the estuaries of the Kura and the Terek; and the Volga brings a still greater quantity of silt into it.

We cannot estimate with any exactness the total quantity of silt discharged annually by the rivers into the seas, nor the consequent lowering of the surface of the land, but we may be sure that the work

of erosion and levelling on the one hand, and that of the deposition of the removed material on the other, is going on on an extensive scale well worthy of exhaustive research. The four principal rivers—Kura, Rion, Kuban, and Terek—carry into the sea at the least 100 million cubic mètres of silt annually (3517 million cubic feet).

Utilisation of Rivers.—The rational use of all gifts of Nature by man is in direct ratio to the degree of his culture. Judging by the use made by the inhabitants of the Caucasus of the swift streams with which Nature has endowed them, we have no reason to depreciate their culture. It is true that these rivers are not by any means utilised to the full extent possible; their enormous motive power is as yet scarcely touched; their transporting power is turned to little account; beds of rivers are still unregulated, and devasting inundations occasionally result; but the inhabitants of the country have understood, and that for a long time past, how to make use of them in one direction—for irrigation. In very early times a net of canals has been constructed in most of the small valleys of eastern Transcaucasia, to conduct the turbid water to distant fields, and the use of the water, its distribution, personal and communal rights, and rights of servitude and passage duly determined by laws and customs. Irrigation, which also enriches the soil, has not always been profitable, for during so many wars and troubles, owing to abuse of power, conflicts and difficulties of every kind have presented themselves, canals have been destroyed and reconstructed only to be demolished again; but through all vicissitudes, irrigation on a large scale has been maintained. If the words of Ezekiel, "Everything shall live whither the river cometh," have not been literally fulfilled yet, they have proved in great measure true. The best irrigated tracts are the lands situated along small streams with a considerable slope, such as the Alazan, Terter, Zanga, and many others. Here all the water is drawn off from the river channel, every drop of it has its value, and the irrigated area exactly corresponds to the volume of water at disposal—about 0·17 cubic decimètres ($10\frac{1}{3}$ inches) to an acre per second. The basins of larger rivers traversing valleys of gentler slopes, those of the Kura, Aras, Terek, are not nearly so well watered, extensive tracts, as the steppes of Mugan, Karabakh, Shirvan and Shirak, being almost deserts. The irrigated area is, however, important, now including some vast domains on the shores of the Kura and Aras—the steppes of Karaias and Arasdaian. A distinction must be made between the more valuable crops, such as cotton, rice, pulse, castor-oil, and other oil-plants, requiring "summer" water, that is, in the hot season, and wheat, vines, and fruits, for which irrigation in spring and autumn suffices, when the quantity of water at disposal is five to six times greater. In the basin of the Kura there were, according to the estimate of the author in 1880 (*Vodovladienia i Irrigatsia*, two volumes, Tiflis), about 170 thousand litres ($37\frac{1}{2}$ thousand gallons) of water available for irrigation in the hot season. At the rate of a continuous discharge above indicated of 0·17 litres (or cubic decimètres) per acre, this is sufficient for the cultivation of about a million acres. The total cultivated area in this basin is certainly more considerable. The

ratio of the length of canals to the irrigated area, in consequence of technical defects and too great a subdivision, is too large—one mile of canal to 120 acres—and there is great waste of water, abuses which the Government is seeking to remedy; but difficulties of every kind, legislative, financial, technical, and administrative, oppose the realisation of a more rational system of irrigation. There is a grand prospect for the future. According to a calculation of M. Gabb, eastern Transcaucasia may with a rational system of irrigation obtain about 1350 cubic mètres (47,700 cubic feet) per second of "summer" water, sufficient to bring under very remunerative cultivation about eight million acres.

Navigation in Caucasia will scarcely have any real importance, few rivers being suited for it. On the Kuban, some thirty years ago, steam navigation was tried. The first steamer, built in London, was 166 feet long and had a draught of three feet, and was found to be unsuitable. Another steamer of 65 horse-power was tried in 1882 with better success. It plied between Temriuk and Yekaterinodar, 132 miles, taking sixteen hours to accomplish the passage down and sixty hours up the river, but soon ceased to run. If this important river is to be rendered navigable its bed must be regulated, for it is sinuous, encumbered with sandbanks and roots of trees, and the estuary is too shallow. Various small craft ply on the Kuban, not exceeding 126 feet in length, and carrying up to 260 tons. On the Kura steam navigation was tried from 1853-57 under the governorship of Prince Voronzof, but has since been abandoned, one part of it—from Ardagan to Borzhom—being too swift, the other part—from its confluence with the Aras to the sea—being reserved for pisciculture. Now only rafts with wood are seen. The Rion is navigable from Kutais downwards, and steam navigation was tried here also in the time of Prince Voronzof, the steamer's draught being 3½ feet, but it was also abandoned notwithstanding the subsidy of 6000 rupees granted annually by the Crown. There are difficulties even for rafts—rapids and tree-roots. The Chorokh, lastly, is navigable in skiffs built of chestnut wood, about 63 feet long and 6 feet broad, carrying from 1½ to 3½ tons and manned by four rowers.

Conclusion.—We are far from having exhausted our subject, for we might give a detailed description of the principal rivers, each of which has its peculiar character, but we have already detained the reader, who has had the kindness to follow us, too long, and we will now conclude with a concise statistical table of the Caucasian rivers. May this paper inspire others more competent with zeal for more thorough investigation.

STATISTICS OF CAUCASIAN RIVERS.

Basin.	Number of Principal Rivers.	Basin.	Number of Principal Rivers.
Black Sea, ...	47	Caspian, ...	79
Azof, ...	8	Gok-cha, ...	16

Principal Rivers.

North Caucasus.

	Tributaries.
Kagalnik (59).[1]	
Yegorlik (184).	
Kalaus (149),	7
Kuma (277),	10
Manych (188),	3
Yeia (Romvit) (145),	3
Beissuk,	2
Kirpili,	2
Kuban (Gipanis) (450),	79
Terek (Lomekhi) (297),	24

Transcaucasia.

		Tributaries.
Caspian.	Kura (Kyros) (710),	405
	Aras (Gheton) (540),	153
Black Sea.	Rion (Phasis) (172),	71
	Chorokh (Zhorok) (214),	22
	Mzymta (52),	1
	Khopa (66),	1
	Bzyb (66),	14
	Ingur (Kherobios) (108),	15
	Kodor (66),	7
Caspian.	Sulak (167),	4
	Samur (132),	16
	Ghilghin,	11
	Bolgaru,	2
	Vilazh,	8
	Lenkoran,	9

Secondary Rivers.

Kura Basin.

Left Bank.	Tributaries.	*Right Bank.*	Tributaries.
Potskhov-Koblian,	23	Alghet,	3
Gherdyman,	6	Khram (105),	17
Gokchai,	5	Akstafa.	
Gr. Liakhva,	13	Akhinja.	
Ksan,	3	Dzigam.	
Aragva (58),	10	Shamkhor,	2
Alazan (185)—Iora (165),	101	Ganzha.	
Ajigan,	10	Kiurak.	
Turian,	8	Terter.	
Akh-su.		Kargar.	

Aras Basin.

Left Bank.	Tributaries.	*Right Bank.*
Western Arpa-chai,	7	Kulpi-chai.
Abaran,	9	Kara-su.
Zanga (59),	11	Sary-su.
Garni-chai,	15	Maku-chai.
Vedi-chai,	11	Kyzyl-chai.
Eastern Arpa-chai (66),	32	Great Kara-su.
Nakhichevan-chai,	10	
Alenji-chai,	3	
Ordubat-chai,	2	
Bergushet-Akiara,	16	

[1] The figures in parentheses are the lengths of the rivers in miles.

Kuban Basin.

Left Bank.	Tributaries.	*Left Bank.*	Tributaries.
Teberda,	2	Bielaia (109),	3
Little Zelenchuk,	5	Pshish (66),	4
Great Zelenchuk,	7	Psekups,	1
Urup (118),	3	Afips,	3
Laba (165),	13	Abina.	

Terek Basin.

Left Bank.	Tributaries.	*Right Bank.*	Tributaries.
Ardon,	3	Sunzha,	7
Urukh,	3	Aksai.	
Malka,	7	Kurpa.	
Cherek.		Aktash.	

Rion Basin.

Left Bank.	Tributaries.	*Right Bank.*
Jojara.		Tskhanis-tskhali.
Tsiteli-ghela.		Tekhur.
Tsiteli-tskhali.		Tsiva.
Dzirula,	7	Ukhut.
Chkhara.		
Kvirila (73).		

Monthly Variations in the Discharge of the Kur.

Month.	Mean Discharge per Sec. in Cub. Metres.	Cub. Kilom per Month.
January	326·6 cub. m.	0·89 cub. km.
February	393·2 „	0·95 „
March	612·7 „	1·64 „
April	1200·5 „	3·11 „
May	1317·7 „	3·53 „
June	1337·5 „	3·46 „
July	406·1 „	1·09 „
August	406·1 „	1·09 „
September	388·2 „	1·00 „
October	403·0 „	1·08 „
November	382·3 „	0·99 „
December	332·6 „	0·89 „
Annual average	625·5 cub. m.	19·72 cub. km.

Ratio of Drainage to Rainfall in the Caucasian Principal River-Basins.

River-Basins.	Drainage Area.	Annual Rainfall.	Mean Annual Discharge.	Per-centage.
Kura	86,214 sq. km.	67·8 cub. km.	19·72 cub. km.	29
Terek	23,085 „	29·5 „	12·00 „	41
Kuban	21,518 „	34·9 „	17·50 „	50
Rion	12,520 „	20·28 „	12·50 „	62

THE KHEDIVIC POSSESSIONS IN THE BASIN OF THE UPPER UBANGI.

By S. H. F. Capenny.

(*Continued from page* 142.)

Ethnography and Organisation.

The population of the Upper Ubangi basin is a miscellany of many races. It awaits a good deal of elucidation ere several of its tribes can receive ethnological classification. The main division is between the ethnographical field of the Upper Nile and that of the Bantu family, the northern limit of which, as represented by the Mombattu and allied tribes, is in a general way the Welle.

In seeking to describe the population in topographical order according to the localities which they populate or dominate, it is necessary to remember that communities of several tribes occur sporadically, some of which are colonies, but most are remanent groups of the tribe which occupied the district before the immigration of the dominant race.[1]

Throughout most of the Upper Ubangi basin the dominant race is the Zande, and it would, in all probability, have succeeded ere now in dominating the whole, and even in passing beyond it to the south as it had passed beyond it to the north and east but for the coming of the white man. It is divided into three great branches, the A-Bánja in the west, the A-Vungura in the centre, and the Iddió or Mákaraká in the east. There is a minor branch, the Digga,[2] which, however, seems to be of mixed race, north of the Mbomu, from the Babado to the Upper Wau. Another minor branch is the Bombe in the east on the Dongu.

Niam-niam[3] (or Nyam-nyam) as a designation for the Zande race attained early currency through the Arabic of the Sudan. It has been borrowed from the Dinka language, where it means "eaters" or "great eaters," and has reference to the cannibal propensities of the A-Zande, as well as their predilection for a flesh diet generally; in the Arabic of the Sudan it has come to be used as a general designation for cannibals; it is a dissyllable, pronounced like Italian gnam-gnam. Mákaraká is the Mittu name of like meaning for the Iddio. Among the Mombattu, the A-Zande are known as Ma-vungula; as there is no original *r* in the Mombattu language, hence the *l*, this is a Mombattu plural representing A-Vungura. Banjia is apparently an Arabicised form of Banja. A-Zande, A-Vungura, and A-Banja, are plural forms in the Zande language.

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[1] As a typical case the territory of Linda in the basin of the Boku may be cited—"As in many other northern lands, Linda's territory was occupied, besides the dominant Zandehs, by Bashirs, A-Barmbos, A-Biri, A-Pambia, and other subject tribes."—Junker's *Travels in Africa*, iii. p. 307.

[2] *Ibid.* ii. pp. 109-112.

[3] Schweinfurth's *Heart of Africa*, cap. viii.

A-Zande is often used by way of distinction for the A-Vungura alone as the true or pure representatives of the race.[1]

Representatives of the Zande race dominate territory from the Kotto in the west, that is, from the N-Sákkara territory, to the Upper Ayi or Yei in the east, that is, to the Mákaraká territory; from the Babado (or Barango) and Bitti in the north to the Likati and the upper basins of the Makongo and the Pokko in the south.

The territory of the A-Banja extends from the Mbomu to the Werre, and from the Babado and Ali to the Welle. Some Banja colonies occupy districts on the south bank of the Welle which the A-Babua have yielded to them between Mbima and Jabbir. The following are A-Banja:—Rafai, Sandu, Bangbale, Dinda, Yámala, Singio, Rua, Bánsinge, Ngérria (Nerria) and Jabbir. Bángasso, the Sultan of the N-Sakkara, and Unguetra on the Likati, are also of Banja birth.

Between the territory of the A-Banja and that of the A-Vungura there is a tract of uninhabited borderland, like the old English markland. A similar tract, as a rule, separates the several Zande states.

The territory of the A-Vungura extends from the Upper Mbomu to the Upper Duru, that is, from Mugaru's territory to that of Wando, and from the Babado, Bitti, and Upper Wau, that is, from the borders of the Banda, Krej, and Golo territories, to the borders of the Mabode territory south of the Bomokandi. To the west of the Werre, between it and the Welle, the A-Vungura occupy a tract, the chiefs of which are Bambagirro and Bagbinne, as well as a tract between the Welle and the Mbima which the A-Babua have yielded to them from Mbima to Siasi. Zande colonies have settled along the south bank of the Welle, from Bomokandi to Amadi, among the A-Barmbo. The leading representatives are the chiefs Semio, Sassa, Mugaru, Ndoruma, Bambagirro, Bágbinne, Tambura, Linda, Wando, Ngerria, Yápati, Bádinde, Másinde, Bauli, Bakangai, and Kanna.

The Mákaraká or Makraka territory is that of the Bombe (or Bongbe) in the basin of the Dongu, and that of the Iddio in the basin of the Upper Ayi or Yei.

According to the Zande tradition, the A-Banja formerly occupied territory beyond the confluence of the Mbomu and Welle, but passed into their present domain when the A-Vungura moved to the north, east, and south. In the north the Zande succeeded in dominating the Sere, Bongo, Pambia, and Golo, but were themselves reduced with the fall of Mofio or Mopa, about 1874, by the Zubeir family. The Mákaraká migrated some sixty or eighty years ago from the Mbrúole district. In 1868 Kipa or Kifa met with his death in fighting against the Mabode, but left behind him a kingdom in the basin of the Bomokandi which is represented in part by the domains of Bakangai and Kanna. All the A-Zande have a common language which varies but little, and notwithstanding their tribal dissensions, they are united as between

[1] Junker says: "Although the Banjias appear to be closely allied to the Zandehs, even in speech and usages, they are traditionally of different descent."—*Travels in Africa*, iii. pp. 184-5.

themselves and the world by a strong sense of nationality. They are a fighting race, and their several states are well organised.

The Mombattu (Mangbattu or Monbuttu) are of most importance among the races and tribes south of the Welle. They are immigrants like the A-Zande, but are superior to them in relative civilisation. Many tribes of different race have become historically affined to them, having adopted their language and customs, such as the A-Bángba (Schweinfurth's Abanga, Emin's Bamba), A-Barmbo, A-Bisánga or Mabisanga, Mamballe or Mangbálle (the Mambare, probably, of Emin and Casati), Nyápu (or Niapu), Méje, Maigo, and Mabōde. Some of these retain their own language.[1]

The Mombattu territory proper is between the Upper Welle or Kibali, as they call it, and the Bomokandi, and mainly in the basin of the Gadda. Their importance has been greatly reduced in recent times.[2] Some of them have migrated and settled to the south of the Bomokandi, and in the basin of the Nepoko. The A-Bangba also occupy territory mainly between the Upper Welle and the Bomokandi, and in the basin of the Gadda. Nyángara and Kabasīdu, who lives to the south-west of Dongu, are A-Bangba chiefs. A-Bangba are also met with between the Mbrúole and the Kápili, and in the basin of the Duru. The Mundu who dwell in the Upper Dongu basin between the Bombe and the Mákaraká, as well as the Babúkur in the Upper Tonj and the Jur basins, are related to the A-Bangba, from whom they have been separated by the Zande immigration. The A-Bármbo (or A-Barambo) occupy territory between the Welle and the Bomokandi, along the Welle from the district of Suruangu to the vicinity of the Panga Falls; south of the Bomokandi, from the Pokko in the east to the Makongo in the west, where they are dominated by the Zande prince, Bakangai. Some A-Barmbo dwell north of the Welle along the east and west sides of the great bend, and a colony of them is found in the basin of the Upper Mbomu. The Mamballe occupy territory about the Gurba, Mbrúole, and along the Welle; they are met with south of the Bomokandi and in the basin of the Upper Bomokandi. The A-Bisanga occupy territory along the south bank of the Welle between Nyangara and Suruangu, and are also found south of the Bomokandi. The Meje and allied Maigo dwell south of the Bomokandi, the former in the Nala basin mainly, and the latter in that of the Telli and Upper Pokko; some Maigo are also found in the Upper Gadda. The Mabode also dwell south of the Bomokandi; their language is different from that of the Mombattu, but a

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[1] "These tribes," Emin says, "are so firmly cemented together by intermarriage, intermixture, habits, customs, and even language, that they not only acknowledge themselves to be subdivisions of one Monbuttu people, but also feel themselves to be so."—*Emin Pasha in Central Africa*, p. 197.

[2] "Some fifteen years ago the original Mang-bettou were masters of the district south of the Wellé; but between the treachery of the Egyptian officers of Emin's troops on the one hand, and the attacks of the Azandé on the other, coupled with the pressure of the Abangba tribe in the north-west, and of the Niapu from the south, these Mang-bettou were dispersed, and their remnant was merged in other tribes."—*The Land of the Pygmies*, by Captain Guy Burrows, London, 1898, pp. 77-8.

Mombattu prince, Mbelia, rules among them two days north of the Nepoko.

The A-Madi occupy the territory in the great bend of the Welle. In the north and centre they are dominated by the A-Zande, the former by Masinde. Colonies of them, known as Nyapu, dwell among the Mombattu, mainly between the Gadda and Bomokandi.

The A-Babua (or Ababwa) occupy territory to the west of the Bomokandi. They are described as tall, well set-up, and handsome, akin to the tribes on the Rubi, and speaking a language different from that of the Mombattu and A-Zande.[1]

The Mobangi (or Mubenge) dwell to the west of the A-Babua, and have been reduced by Jabbir; they are described as a hardy, fighting race, honest and faithful, making the best of soldiers.[2]

The Momvu (or Momfu) occupy territory in the basin of the Upper Bomokandi and the Upper Welle (Zoro). Some of them are found among the Mombattu.

The Akka (of the Mombattu) or Tikki-tikki (of the A-Zande), nomadic Pigmies, are found dwelling or roaming among the Mabode, Maigo, and Momvu. There are two tribes, the black and the red. Their own name is Achua or Wochua, of which Akka is a corruption.[3] They represent probably the primitive race of the Welle basin.

Along the banks of the Welle, and on the habitable islands from Yakoma to Suruangu, dwell the A-Bâsango or A-Bata (Embata or Ambata).[4]

According to native tradition, the original inhabitants of the Mombattu ethnographic field were A-Bangba (or Mundu), A-Bisanga and Mambare. The first folk-wave of invasion came with the Meje and Maigo. These contended with each other for the possession of the Gadda and Bomokandi basins, and were followed by the A-Barmbo, Mabode, Mombattu, and Momvu.[5]

In the east and north-east of the Welle basin, and on the borderlands between it and the Nile basin, several tribes represent Nilotic races. The Luri belong to the Shuli; the Lendu, Lubari, Kalika, Logo and Brera in the Upper Welle basin, and the Abukaya in the Upper Garamba basin, belong to the Madi; it is possible, but it is not settled, that the A-Madi on the Welle may also belong to the Nilotic Madi; the Kakuak and Fajelu, on the borders from Janda to Ndirfi, belong to the Bari; the Abaka, on the borders of the Upper Garamba and Upper Akka, belong to the Mittu.

An estimate of the population is :—Mombattu, 1,500,000; A-Vungura, 2,000,000; A-Banja, 2,000,000; A-Babua, 200,000; A-Basango, 50,000.[6]

The territory[7] of the Congo State in the Upper Ubangi basin is

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[1] *The Land of the Pigmies*, by Captain Guy Burrows. London, 1898, pp. 202-3.

[2] *Ibid.* pp. 211-13. [3] *Ibid.* pp. 174-181. [4] Gustin, *op. cit.* col. 296.

[5] Casati's *Ten Years in Equatoria*, i. pp. 95-6.

[6] "Referendum sur la question de la population du Congo." (Note on the Welle by Captain Daenen), *Mouvement Géographique*, 1895, col. 93.

[7] *L'État Indépendant du Congo.* Par A. J. Wauters. Bruxelles, 1899, pp. 440-6. Burrows, *op. cit.*, p. 221.

organised into the Ubangi district, with its capital at Banziville, and the Welle district, with its capital at Jabbir. Yakoma is in the Ubangi district. The Welle district is subdivided into four zones: the Rubi-Welle zone, with its capital at Jabbir; the Werre-Mbomu (or Bomu) zone, with its capital at Werre; the Makua zone, with its capital at Nyangara; the Makaraka zone, with its capital at Surur (or Vankerkhovenville); Unguetra (or Enguetra) on the Likati, and Ibembo (or Bembo) on the Rubi, belong to the Rubi-Welle zone. A commissioner is at the head of each district; heads of zones report directly to the governor in certain cases as well as to the commissioner. Residents or agents are appointed to certain of the chiefs.

Beyond the Mbomu the Sākkara[1] (or N-Sakkara) occupy territory from the Kotto to the Shinko and the Mbomu down to Madabungu, and from the Duru in the north to 4° 20′ S. lat. Its area is estimated at 16,000 square miles (40,000 kil. carrés); its population at 120,000, some 10,000 of whom permanently bear arms. It is a well-organised state. Its sultan, Bangasso, governs directly with the aid, as vassals, of his brothers Lengo and Pengo, his son Bali, and the chiefs Bakuma and Satte (or Sattet). The reigning family is of Banja race, which reduced the Sakkara some 250 years ago when the Sakkara occupied the basin of the Bali. A campaign is conducted annually against the Bubu to the west of the Kotto in honour of Bali, Bangasso's father, who fell in battle against them. In the north they contend with the Vidra (or Vedri). The Dendi, as the Sakkara call them, are a riverine tribe along the Ubangi and Mbomu, which is allied to the Bongo who dwell south of the Ubangi.

The Banja domain of Rafai[2] comprises territory between the Babado in the north, the Warra in the east, the Mbomu in the south, and the Shinko and Ngaua in the west. The Banja population is estimated at 15,000. Former vassals of Rafai, south of the Mbomu, now recognise Jabbir as their suzerain.

Several[3] tribes occupy territory between the Shinko, the Upper Wau, and the Upper Mbomu. Some of them are dominated by Rafai, some by Semio, and some remain independent. The A-Kare (or A-Kale, Junker's A-Kahle) occupy territory between the Warra and the Mbomu; an important village is Gayamba. Rafai dominates the A-Kare of the west from his post at Dinda. The Biri occupy the middle course of the Warra. The Gabu occupy the Upper Babado, the Ali, and the district between them and the Warra. Rafai dominates the Gabu of the west from his post at Aka. In the east the Gabu and A-Kare are dominated by Semio. The Sēre, or Bashīr as the A-Zande call them, occupy territory to the north and south of the Upper Mbomu. Urindimma is a Bashir with a colony of his race on the Upper Mbili, where he held sway as Lupton's agent over a Banja population.

The A-Banda[4] consist of several tribes, and occupy territory from the right bank of the Babado, with the upper basins of the Bali and the

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[1] "Le Sultanat de Bangasso." Par le Lieutenant Lalieux, *Mouvement Géographique*, 1896.
[2] De la Kéthulle, *op. cit.* p. 408. [3] *Ibid.* p. 411. [4] *Ibid.* p. 424.

Kotto, to the borders of Dar Runga. The principal tribes are those of Yangúba, Sango, Zwarra, Yangu, Wassa, Vidra (Baraka, Gambo, and Songo), Mokubanda, Yangura, and Mbele or Bele; Zwarra, Yangúba, and Sango pay tribute to Rafai, who has been striving to dominate the Vidra and Wassa up to Sabanga in the Upper Kotto.

North of the A-Banda the Krej[1] or Kresh tribes occupy the Upper Shinko. Bandassi is chief of the Guarna and the Marra; Alewali, of the N-Dolo; Renogo, of the N-Dogo; Kerengigi, of the Naka; Mereke, of the Aja. The native population is Krej up to Katuaka and Hofrat-en-Nahas, where the chiefs are now Arabs from the north.

Shala,[2] the territory of the Kara, and the territory of the Dajo (Slatin's Tago) come between Dar Fertit, Wadai, and Darfur. The Dajo, with their sultan, Abu Risha, belong to Wadai.

Economic Characteristics.

Economically viewed, as determinative of occupation,[3] the basin of the Upper Ubangi may be divided into forest, savanna, and steppe. Forest—the Great Forest—and fertile plains are the dominant characteristics south of the Welle. The chase is the main occupation for food as well as ivory. There is some agriculture, which is, however, the main and characteristic occupation of the Momvu. North of the Welle is the savanna, with tracts of steppe; it has been termed park-land and bush-land, with its open and undulating plains of tall reedy grass on a laterite formation. There the forest is found only in the deep troughs of the upper valleys, where it becomes the celebrated "gallery forests." The chase of the elephant and antelope, which abound, is the main or sole occupation of the A-Zande, with some cultivated fields for cereals in the vicinity of their habitations. In the west, however, the Great Forest seems to be prolonged to the north of the Welle, up to the Mbomu. In the east, among the Nilotic tribes, where it is savanna and steppe, the main occupation is pastoral, with some agriculture.

Many of the tribes are noted for skill in handicrafts of wood, iron, copper, and ivory. The Momvu, besides their skill in agriculture, are noted for their skill in making palm-oil. The Mombattu are celebrated for their bark-cloth, from the bark of a *Urostigma*. It is called by them *noggi*, but *rokko* by the A-Zande, and this has become the general name for it. The riverine populations are celebrated for their skill as boatmen, both as paddlemen and pilots.

North of the Mbomu the forests in the valleys, especially in the valleys of the Shinko, where the elephant abounds, the fertile plains and valleys, with savanna and steppe in the uplands, lead to the chase, agriculture, and pastoral occupations.

The Welle is a well-defined line of vegetal life. The banana and oil-palm are seldom found to the north of it; but in the basin of the

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[1] De la Kéthulle, *op. cit.* pp. 425-7.

[2] *Ibid.* p. 529.

[3] A dissertation, "La Vie des Peuples du Haut Nil," by M. E. de Martonne, in the *Annales de Géographie* for 1896 and 1897, deals with the correlation of Physical Geography and Ethnography as illustrated by the population of the Upper Nile and Upper Ubangi.

Mbomu both are found thriving up to Yangu and Sango, in Dar Banda, say up to the 6th parallel of north latitude.

Of economic plants the following are in general cultivation :—Cassava, banana, plantain, maize, sorghum, millet, telebun and sesame, yams, sweet potatoes, arachis, tobacco, and, in some parts, cotton.

Iron is found in most parts, copper in the Sakkara territory; but salt is universally wanting.

The seasons are determined by the rains. In the Welle district the rainy season is from the middle of July to the middle of December, with a shorter rainy season from the middle of February to the middle of March. North of the Mbomu the rainy season lasts from the middle of April to the middle of November. There can be no doubt, says De la Kéthulle, as to the salubrity of the climate north of the Mbomu; on the uplands the air is keen and healthy.

The foreign trade is mainly in the following products :—Caoutchouc, ivory, palm-nuts, palm-oil, copal, kola-nuts, ground-nuts, woods, and spices.

In the Mbomu basin the forests in the valleys are very rich in caoutchouc, coffee, ebony, copal, tamarind, and gum; caoutchouc and coffee are especially abundant in the valley of the Mbomu.

Communications are among the most important considerations. With regard to the Welle district, the Ubangi and the Rubi provide ways of access. It seems probable that Ibembo or Bembo, where the Rubi becomes innavigable, will be the port of the Upper Welle since it has been decided to build a line of railway from Ibembo to Bomokandi. The usability of the Ubangi is limited considerably by the rapids of the Zongo Gut, which are hardly passable at certain seasons, and by the rapids at Banziville. Between the Mokwangu Falls, where the Ubangi navigation terminates, and Jabbir, the capital, the Welle is cut up by several rapids. To arrive at Jabbir, the alternative route up the Rubi to Ibembo is often adopted, and overland, by way of the Likati valley and Unguetra. The Welle, however, may be regarded as usable by boats up to Surur; even where the rapids make a portage of goods necessary, the boats themselves can travel without difficulty.[1] It is hoped that some of the difficulties that beset navigation may be mitigated. From the Welle to the Nile one line of communication has been determined in the Agreement between England and the Congo State, by which the latter is to have a strip, some 16 miles wide (25 kil.), from the borders of the Welle district to Mahaji, or Mahagi, as a port on the Albert Nyanza. From Dongu there is a probable line of communication up the Dongu valley to Mundu, or its vicinity, thence by way of the Upper Garamba to Tendia, where a col leads easily into the basin of the Nile, and thence through Makraka and Nyambara to the navigable Nile at Rijaf (Regaf) or Lado.[2] Formerly there was a line of communication

[1] Burrows, *op. cit.*, p. 55.

[2] "The water parting between the Nile affluents and those of the Dongu, formed by the heights which extend from Ndirfi towards Tomaya and Gabologgo, has near Tendia a convenient depression for passing into the territories of the Makraka.

"By following the valley of the Dongu and the banks of that river as far as Ba (in the

from the Welle—from Mombattuland—to Meshra-er-Rek by way of the Rol valley, through the Abaka and Moru territories.

A good deal has been heard of the potamic system of communication, by which it is asserted there is but one break between Brazzaville and Cairo. It was known to Gessi[1] that the Upper Jur, or Sue, was usable for boats, and he had determined on utilising it as a line of communication between Meshra-er-Rek and the Zande lands. It has now been found[2] that the Yobo, a tributary of the Sue, is navigable up to Tambura. The Upper Mbomu and Boku have also been found navigable up to Mere. These points are some 48 miles (76 kil.) apart. But in considering the usability of this potamic highway up the Mbomu, it is necessary to keep in view that the navigation of the Ubangi terminates at Wangu, even if the Zongo Gut were passable at all times. From Wangu to Madabungu there is a march overland of three hours.[3] From Madabungu to Bangasso, which is two days in a pirogue, many rapids succeed, and navigation is difficult.[4] From Bangasso to Sandu there are several rapids, and the Ngufuru Falls, where another break is necessary. Between Yakoma, or Abira, and Meshra-er-Rek, therefore, there are several breaks in the line of communication.

Formerly the lines of communication between the Mbomu basin and the Bahr-el-Ghazal passed mainly through Dem Bekir, Dem Guju, and Dem Zubeir, to Wau and Meshra-er-Rek. From Dem Zubeir the caravan highways led by way of Gondu through Shakka and Dara to the Nile at Khartum and Dongola. The caravan highway between Dar Banda and Dar Fur was that reported by Browne and Barth. But there is also a caravan highway from Dar Banda through Dar Runga and Wadai to Benghazi. According to De la Kéthulle,[5] Arab caravaniers come annually in the dry season to Yangu in Dar Banda. From Yangu to Kuka, in Dar Runga, this caravan highway passes through Mereke, Dombago, Yanguru, Sabanga, Moruba, Wundu, and Mbele or Bele.

The population of the Mbomu basin have long been receiving goods from Europe by these different ways, and they show a keen demand for them. Now that Dongola and Khartum are in rapid communication with Cairo, it seems probable that a through line of communication between the Nile and the Ubangi may become one of the great highways of trade in Africa.

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vicinity of Mundu), and then taking a direction to the north-east, one reaches the Tendia table-land. The road is easy and good, and not broken by swamps or large rivers. The Garamba, which can be forded in the upper part of its course, is the largest stream. Meadows of long grass cover the country, and are inhabited by numerous buffaloes and antelopes. The native villages are surrounded by large and rich fields of Indian millet and manioc. Trees of *Bassia Parkii* grow everywhere. . . . The population on the right bank of the Dongu is composed of Sandeh people ; a small colony of Madi and Abukaya inhabit the Upper Garamba valley. . . .

"From the Kibali the land gradually rises without abrupt elevation from 2200 feet (670 mètres) above the level of the sea to 2650 feet (810 mètres) at Tendia, where we arrived on the twelfth day after our departure from Tangasi."—Casati, *op. cit.* i. p. 252.

[1] Gessi's *Seven Years in the Soudan*, London, 1892, p. 427.

[2] *Bulletin du Comité de l'Afrique Française*, October 1898, pp. 325-330.

[3] "Lettres de l'Ubangi." Par le Lieutenant Stroobant, *Mouvement Géographique*, 1896 col. 184.

[4] *Ibid.* 185.

[5] *Op. cit.* p. 425.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

New Members.

At a meeting of Council held on May 2nd, the following gentlemen were elected Members of the Society :—

Carmichael, E. K.	M'Kerrow, George, M.B., C.M.
Fenwick, Bruce.	The Geographical Institute of the University of Budapest.

The Society's Diploma of Fellowship was granted to Andrew Coats, Esq., and George Rattray, Esq., M.A., of Graaff-Reinet.

Lecture delivered in May.

On May 2nd Mr. J. A. T. Ross Cormack, F.R.S.G.S., addressed the Society in Edinburgh, his subject being "Five Years in South Africa." At the same meeting Mr. Nilson read a short communication (which is published among the following notes) on the forthcoming expedition under Professor Nathorst, of Sweden, in search of Andrée. Dr. George Smith presided at the meeting.

At Aberdeen, on May 11th, Colonel Bailey described a journey "Across Canada from the Atlantic to the Pacific." Sir David Stewart took the Chair, and Mr. Wm. Graham proposed the vote of thanks.

GEOGRAPHICAL NOTES.

By The Acting Editor.

EUROPE.

The Meteorology of Edinburgh in 1898.—Several exceptional variations were recorded during the past year, as shown in Mr. Mossman's report published in the *Proceedings of the R. Physical Soc.*, vol xiv. The mean temperature in January, 44·6°, was the highest recorded since observations were commenced in 1764. There was no frost or snow, and the rainfall was less than one inch. The mean barometric pressure was much above the normal, but the sunshine greatly below the average. In February the temperature was high, the pressure rather low, and the rainfall small, but the sunshine was much in excess of the average, being 90 hours. In April also the mean temperature was high, 2·7° above the average. The most remarkable feature in June and July was the deficiency of rain, the quantities being 66 and 38 per cent. of the normal, respectively. During August the mean temperature was 1·2° above the average, and between the 3rd and 17th of September there was a remarkable spell of warm weather, the temperature being 63·6°, or 8·5° above the normal, while on the 4th, 5th, and 6th the maxima were 82·0°, 82·8°, and 80·0° respectively. The unusual warmth was the more oppressive as the air for several days was nearly saturated with moisture. October and November were also exceptionally mild, and the mean for December was 44°, which is no less than 5·7° above the average. The only milder Novembers since 1764 were those of 1842, 1843, and 1857.

During the year a number of kites of the Blue Hill pattern were experimented with. No instruments have yet been set up, but an elaborate and costly meteoro-

graph has been ordered from M. Richard of Paris. It will be made of aluminium and will weigh less than three pounds. By the liberality and energy of Mr. John Anderson, who has directed the operations, and of the donor of the meteorograph, Scotland will soon be able to join in the international scheme of aerial investigation inaugurated by Mr. Lawrence Rotch, director of the Blue Hill Observatory.

ASIA.

San-mun.—Of the bay in Che-kiang that has lately been demanded from the Chinese by the Italian Government, Dr. Mario Carli gives a description in the *Boll. de la Soc. Geogr. Italiana*, vol. xii. No. 4. The mouth of the bay may be defined as a line running from Cape Conway, the south-eastern extremity of the island Niu-tiu, lat. 29° 3′ 22″ N. and long. 121° 57′ 43″ E., through the islands of Li-ming, San-che-san (or Triple Island) and San-mun to a point on the coast in lat. 28° 56′ 15″ N. and long. 121° 44′ E. The distance between the extreme points is about 15 miles, and the bay extends north-westwards from its mouth for a distance of about 25 miles into the mainland. The word *san-mun* signifies "three gates," the entrances into the bay being three in number. The most important, from its depth and safety, lies between the islands Li-ming and San-che-san, in which the water has a mean depth of 12 fathoms. In the second passage, between San-che-san and San-mun, the depth is only 5½ to 6½ fathoms. The third passage has not been explored, but it is certainly still shallower. A vessel entering by the first passage has also the advantage of the protection afforded by the island Li-ming against the strong currents that set in during spring tides and the north-east monsoon. Passing to the south of the island Kone, captains cast anchor in water over 4 fathoms deep half a mile from the southern shore of St. George island, which lies 4 miles north-east of Kone. To the north the bay forms a deep inlet called Ta-hwa, which is shallow and full of banks and rocks. West of St. George lies a group of islands, and between these and the mainland a broad channel with depths of from 8 to 22 fathoms, and at Quarry island on the west there is good anchorage on the southern shore in depths of 5 to 8 fathoms. Here also the bay sends off a branch northwards, which has not been sounded.

The port of Shi-pu is a branch of the bay of San-mun lying between the main land and the islands Kin, Kin-yang, Niu-tiu, Tai-mun (Sin) and Tung-mun. It may be entered by vessels of small draught by a passage to the north of St. George. There are also three entrances between the islands on the east, of which the one between the islands Tai-mun and Niu-tiu seems to be the least dangerous and to have a depth sufficient to allow vessels of deep draught to pass directly to Shi-pu; but according to native reports, it contains rocks not indicated on the charts. The town of Shi-pu is situated on the mainland at the northern side of the harbour. Commercially it is of little importance, though the busiest place in the neighbourhood. Other centres of population are the two large villages of Che-pu at the extremity of the great western inlet of Man-ngao near the mouth of the river Ning-hai.

The northern and western shores are almost quite flat. On the north a great plain extends from the Ning-hai to the Nimrod strait formed of alluvium, and remarkably fertile. The poppy is gradually excluding all other crops. Opium is exported in large quantities into the interior, and the local consumption is increasing rapidly. Another product that is of importance as an export is vegetable tallow (*Stillingia sebifera*). The western coast is flat for a certain distance and is cultivated, like the Ning-hai peninsula, but on the north-east the mountains which

lie to the west of Ning-hai send out branches to within 7 miles of the bay. Iron is abundant there, but the natives only wash the grains of the metal from the sand in the streams and carry it to the foundries of Ning-hai. On the south side the mountains come down to the shore with a height of fully 1000 feet, and run out into the sea in promontories. The soil here is less productive, but the crops are more varied, including, besides opium and vegetable tallow, rice, green tea, bamboo, rhubarb, and other medical plants. The islands are all hilly, and their coasts sink almost precipitously to the sea. In the north-east of Niu-tiu the elevation is 1400 feet above sea-level.

AFRICA.

The Red Sea.—A sketch of Prof. Luksch's report of the expedition of the *Pola* in the southern part of the Red Sea is given in the *Mitt. der k.k. Geogr. Gesellschaft in Wien*, Bd. xlii. Nos. 1 and 2. This part of the sea contains six considerable hollows lying nearly on the central line. The most northern is in about lat. 22° N., and in it the deepest sounding hitherto made in the sea was taken—1197 fathoms. The next depression, in 20° N. lat., sinks to a maximum depth of 1190 fathoms. The third, in 19° N. lat., has a maximum depth of 835, and the fourth, extending from lat. 17° to 16°, of 715 fathoms. Only 15 nautical miles farther south lies the fifth hollow, with two pits of 887 and 859 fathoms, and a little to the north of the island Zebehr is the sixth, with a depth of 649 fathoms. The strait Bab-el-Mandeb, divided by the Perim island, is not only narrow but shallow. The eastern passage is only 2 nautical miles wide, with a maximum depth of 16 fathoms, and the western is 12 nautical miles broad and sinks in places down to more than 160 fathoms.

The temperature of the water in the southern parts of the sea is relatively high, sometimes higher than in the northern part, while the specific gravity is in general less. Both temperature and salinity diminish towards the bottom. From about 380 fathoms downwards the temperature remains constant at 70·5°. A daily range is observable down to 55 fathoms. The highest surface temperature, recorded on Oct. 9th, 1897, was 90·5°, and the lowest, near Suakin on January 22nd, 1898, was 73·5°. The highest salinity was 4·08 per cent. at a depth of 487 fathoms off the African coast opposite Jeddah on Oct. 3rd, and the lowest 3·62 per cent. found at the bottom of the harbour of Perim, 12 fathoms deep, on Dec. 4th. On the whole the water on the Arabian coast shows greater heat and lower salinity than that on the African coast in the same latitude; on both the temperature rises towards the south, while the salinity decreases. In the harbour of Perim, and in the eastern channel, the salinity at the surface is much the same as in the Indian Ocean between Perim and Aden, and lower than is found elsewhere in the Red Sea. In the depths of the western channel, on the other hand, the salinity is high. It would seem, then, that water from the Indian Ocean flows in on the surface, while the salter Red Sea water passes outwards at lower depths.

Weather Forecasting in South Africa.—In two pamphlets presented to the Society, Mr. D. E. Hutchins discusses the climate of South Africa chiefly as regards rainfall. The variations of rainfall he ascribes in great measure to the varying strength of the south-east trades; and the failure of south-east rains from November 1895 to March or April 1896, and the cyclical variation of weather in South Africa, led him to predict the failure of the Indian monsoon in the latter year and the consequent drought. In a paper written in 1890 for the Royal Meteorological Society, Mr. Hutchins predicted that the years of good

rainfall at the western stations would be 1892 (Meldrum's cycle of 12·5 years); 1894 (Sunspot cycle of 11·11 years); and 1897 (Storm cycle of 9·5 years). The fall in 1892 was greater than was anticipated, the Sunspot cycle came one year late, and in 1897 at Cape Town there was a small deficiency in the rainfall figures. A remarkable anticyclone was formed in July, but floods and storms occurred at other seasons and the crops were good. The Storm cycle is the most important in the meteorology of western stations. The lateness of the Sunspot cycle may be due to the fraction in the period 11·11 years. The fraction 0·11 year in the period amounts to about a year in the century, and if the sunspot maximum occurred exactly in 1850 there would be now a retardation of about half a year. At the eastern stations the sunspot rains were punctual, for the sunspot maximum affects the eastern and western districts in different ways, the rains in the former being spread over two or three years, while in the latter there is a single year of heavy rain. The meteorology of India showed a marked parallelism to that of South Africa in the years 1892 to 1896. 1893, the year of maximum rainfall in India, was also the year of maximum fall at Evelyn Valley, at Grahamstown and other eastern stations; 1892, 1893, and 1894 were all years of heavy rainfall in India, while at Durban heavy rains occurred in 1892-3, 1893-4, and 1894-5.

Mr. Hutchins maintains that the averages given in Dr. Buchan's *Discussion of the Rainfall of South Africa* (see vol. xiv. p. 97) are too high, since the ten-year period under discussion happens to include the years 1888 (Storm cycle), 1892 (Meldrum's cycle), and 1894, the beginning of the sunspot rains. Up to 1892 sunspots and rainfall corresponded fairly because the Sunspot and Storm cycles happened to fall near together. All the three cycles are now drawing together, and they will soon almost coincide, followed by long periods of drought such as prevailed between 1841 and 1850.

German East Africa.—In *Globus*, Bd. lxxv. No. 13, Dr. Brix Förster publishes an account of the economic condition of this territory. Its trade has of late steadily increased, and in 1897 the value of the imports was £468,500, and of the exports £256,000. India, Zanzibar, and Germany take nearly equal shares in the trade, Germany not quite so much as the other two. The products of the country are ivory, indiarubber, copal, mtama, sesamum, copra, and wax, and tobacco, sugar, and coffee raised in plantations. Only the ivory is falling off in quantity, the herds of elephants having been reduced by the hunters, and the stores of the native chiefs becoming exhausted. The collection of indiarubber makes steady progress, and the article fetches higher prices, most probably because it is brought to market in a better condition. Much attention is paid to palms, but it is to be feared that the supply of copra will soon exceed the demand, for France is the only purchaser. Wax is a new article, and seems likely to be of importance in the future.

But the welfare of the territory will depend in the main on plantations. The tobacco crop, which is supposed to be not particularly suited to the East African soil, has been trebled since 1895. The quality is poor, and the tobacco finds purchasers only among the natives and the Arabs; the finer article is exported from the European plantations in very insignificant quantities. The production of sugar has also considerably increased, but only the Arabs are concerned in it. Coffee, therefore, is almost the only crop found on the plantations of German firms. In the year 1897-98 the plants suffered much from drought and locust swarms, but nevertheless the export was nearly three times that of the preceding year. Planting is extending very slowly, but steadily. There is no want of labour; the costly coolie has been dispensed with, and his place is taken by natives from the interior,

from Uniamwesi and Usukama. Neither is capital deficient, though it does not always find suitable investments.

The Government has constructed nearly eight hundred miles of roads for wheeled traffic. In the northern part of the territory Tanga has been thus connected with Taveta and Moshi; in the central portion roads have been made from Bagamoyo to Kilossa, from Kilimatindi to Tabora, and from Seke in Usukama to Muanza, at the south end of the Victoria Nyanza; and in the south from Kilwa to Barikiwa and Chechere towards Songea and Lake Nyassa. Consequently caravan traffic has much increased throughout the territory.

It has often been discussed whether the higher districts of German East Africa would afford a suitable home to the German peasant. The climate is favourable (77° F. by day, and 50° to 54° at night), and the soil is fruitful. West Usambara, 3900 feet high and over, is free from malaria, but a man who has caught the infection on the way from the coast does not recover more quickly there, in spite of the fresher air. Of the fertility of Uhehe opinions differ, while of Kwai in Usambara, east of the Magamba mountains and north of Wuga, 5200 feet above sea-level, the reports as to the growth of corn and even tea are very favourable. The land, however, has to be cleared of stones and roots, and a settler requires at least £500 to tide over the first years. The Tanga-Korogwe railway was much needed for the prosperity of the numerous plantations of Usambara. Uhehe stands in need of water communication on the Rufiji and Ulanga, and it is doubtful whether these rivers can be thus made use of by steamers.

There are still large blanks even in small-scale maps. Many of these are no doubt thinly peopled barren steppes. But that is not the case in the north-west corner, between Mpororo and the Mohasi lake. Captain Bethe traversed it in 1898, starting into the unknown at the west end of Mohasi lake. To the south he noticed two smaller sheets of water, the Luhita and Mashangia lakes, perhaps expansions of the Nyavarongo river. Marching northwards he came to bare lofty highlands running east and west, where the valleys were cultivated by Watussi. Thence a plateau covered with bush extends to Kukizi, on the southern boundary of Mpororo. Captain Bethe then came to the group of volcanoes east of Mfumbiro, visited by Count von Götzen, and ascended one named by the natives Kirunga, which he estimated at 13,000 to 16,000 feet high. It is, therefore, the highest of the range. Its crater, 100 to 150 yards broad, is filled with water. The mountains are drained by the Nyavarongo, which joins the Kigera.

Father Adams and Lieutenant Glanning have explored part of the country between Kilwa and Lake Nyassa. It appears that the Levugu rises east of Hango, or Shabruma's territory, at 16° 10′ S. lat., and 36° 5′ E. long., not in the Matogoro mountains near Songea. At first it flows through narrow fruitful valleys, entering at the confluence with the Mbarangnanda into a wide sandy plain. It runs from south to north past the foot of the Mbari range, and enters the Rufiji at the Shuguli Falls. Adams was the first white man to visit the Upogoro country. The mountains, 2300 to 2600 feet high, have an imposing aspect from a distance, and their luxuriant vegetation, and the grotesque forms of their rocks, strike the eye on a nearer approach; but the swampy hollows in the neighbourhood spoil the pleasure of a sojourn in this country, producing malaria and rheumatism.

AMERICA

The Climate of the Klondike District.—Prof. Hann has published in the *Meteorologische Zeitschrift* the following means obtained from various data:—In Dawson City the mean temperature is for January −23·6°; Feb., −12·5°; March,

2·5°; April, 19·4; May, 31·2°; June 45·9°; July 55·8; August, 50·5; September, 39·4°; October, 20·3; November −0·9°; December −16·2°. The absolute extremes −68° and 81°, and the absolute range, about 149°, are not extraordinarily large for the latitude and a continental climate, and not so great as in Eastern Siberia on the same latitude, where the annual range is larger and the mean temperature much lower. Field and garden cultivation are almost impossible. A few lettuces and cabbages have been grown with difficulty, but potatoes are bad. The temperature of the river water from June to December is between 46° and 57°, and therefore frosts are seldom in the neighbourhood, though they generally occur in these months. The ice breaks up about the middle of May (see vol. xiv. p. 154), and the river begins to freeze up again in the middle of October, and attains a thickness of nearly four feet. Snow falls to the depth of forty inches, being fairly evenly distributed over the months from October to April. The wettest months are June, July and September.—*Geogr. Zeitschrift*, Jahrg. v. Heft 4.

The Rio Magdalena in Colombia.—The silting up of this river has for some time past given cause for anxiety. Both on the Upper and Lower Magdalena steamers meet with greater obstacles than formerly. Mr. Welton, who has known the river since 1856, remarks that the causes of the change are very evident. In 1856 steamers drawing four to five feet of water could ascend the river to Caricoli, whereas now steamers of three to four feet draught cannot get beyond Yeguas. Since 1856 many families from Antioquia have settled on the flanks of the central Cordillera and have there founded a large number of villages and small towns. Trees have been cut down freely, and every year the forests are being cleared; and the waste has been so great that it is now difficult to find trunks large enough for planks, and building wood is becoming scarce. The soil is very loose, and being no longer held together by the roots of trees is swept down by the heavy rains into the brooks that feed the Magdalena, so that only the yellow loam is left which will not repay cultivation. The rainfall is said to have diminished and the evaporation on the now unsheltered land is much more considerable. The water runs off more rapidly and causes sudden spates in the river which carry down a large quantity of solid matter and deposit it where the stream expands or where from a diminished fall the current slackens.—*Globus*, Bd. lxxv. No. 16.

Patagonia.—A letter from Dr. Steffen written in the Baker channel is published in *Petermanns Mitt.*, Bd. xlv. No. 3. With Mr. Hambleton he had crossed the S. Rafael lagoon and the isthmus of Ofqui and then explored the various fiords running inland from the east coast of Penas Gulf. All the inlets from the isthmus southwards to Baker channel proved to be barred at the upper ends by huge glaciers terminating in lofty walls, so that it is extraordinarily difficult to cross the Cordillera between 46½° and 47½° S. lat. The Baker channel, which penetrates sixty miles into the land, offers passages into the interior by the valleys of three large rivers. Dr. Steffen had traced the largest, which he called Rio Baker, for a distance of twenty-two miles inland and found it to be a fine waterway comparable with the Rio Cisnes. It runs on the whole east-north-east, that is, in the direction of Lago Cochrane, and the colour and temperature of the water seem to indicate a lacustrine origin. Another large stream enters an eastern arm of Baker channel coming from the east, while in the south-eastern branch is the mouth of a third voluminous river, which has a rapid current and probably has its source in the glaciers of some distant mountain; perhaps it is identical with the Rio Mayer discovered by the American traveller Hatcher. The second river has been

named by Dr. Steffen Rio Bravo, and the third Rio de la Pascua. South of San Quintin the vegetation suddenly becomes stunted. The prevalent form is Tepie (a Myrtacea), forming thickets which much impede the traveller. *Libocedrus tetragona* is plentiful, but there is no *L. Chilensis*; masses of moss cover the heights. The snow limit lies not more than 2000 feet above sea-level. Huemules (*Cervus antisiensis*) are very numerous.

Herr Oscar Fischer has also been successful. He has travelled from the Reloncavi fiord near Puerto Montt, north-westwards up the Cochamo river. This is probably the long-sought Buriloche route used 200 years ago by the Jesuits to reach Patagonia from Chiloe.

POLAR REGIONS.

Herr Andrée and the Search Expedition of Prof. Nathorst.—At a meeting of the Society in Edinburgh, on May 4th, Mr. Nilson read the following communication:—

"It will be two years next July since Andrée and his two companions started by balloon from Spitzbergen for the North Pole. A few days after his starting, a carrier pigeon brought a message from him that the expedition, on July 13th, 1897, was at 82° 2′ N. lat., and 15° 5′ E. long. Since that time we have not heard anything of him except idle rumours.

"In what direction and under what circumstances the balloon continued its way can only be guessed at. Not the slightest trace of it or its passengers has been observed; not one of the floats or buoys, with letter enclosed, which Andrée intended to send down from the balloon, has been found. As a matter of fact, nothing has yet *proved* the loss of the expedition.

"Before starting, Andrée expressed his hope of landing in the neighbourhood of the Pole, either on some island there, or on the ice, and that he should be able to reach from there, by crossing over or drifting with the ice, regions where he could expect to find assistance.

"By the experience of Nansen we know that the conditions in the Farthest North are not at all comfortable, but he also has proved that by prudent measures and energy it is within the reach of man not only to support himself for months on the Polar ice, but also to reach on it many points of the Arctic.

"Now the question is:—How has Andrée landed? Has he been forced to it, and through some mischance lost his provisions and ammunition, and thus been unable to prepare for and secure his retreat? or has he landed all right either on the ice or on some island and been able to start from there in health and strength, and in good order?

"In the latter case, which we would fain hope is the real one, we must remember that he took provisions with him for more than three months, and ammunition for two or three years, and he must have had plenty of time to prepare his winter quarters, and to replenish his store of provisions. As far as the season has allowed he has probably worked southwards by sledge and canoe.

"The New Siberia Islands and the coast of Siberia, with the exception of the Tamyr Peninsula, were partly explored by Swedish and Russian expeditions last year, and every year those regions are visited and crossed by natives.

"Nova Zemlia is inhabited in some parts, and Franz Josef Land was touched by one or two expeditions last year, and one expedition is now known to be wintering out there—the Wellman Expedition.

"If Andrée has landed on the northern part of Franz Josef Land, it must, on

account of the want of dogs, take him one or two summers to reach the southern part, and therefore it is hoped that one or other of the expeditions will find him.

"As for Spitzbergen, King Charles Land, and Bear Island, these were carefully searched last year by Professor Nathorst, and this year the Swedish-Russian Geodetic Expedition is going to winter in Spitzbergen.

"If the balloon took a course to the northern part of North America, there is not very much hope of Andrée being saved on the west side of Greenland; but, on the other hand, there is a chance that his expedition may meet this year either with whalers or with the expeditions of Peary or Sverdrup. Those expeditions are also to search round the northern and north-eastern coast of Greenland, and they are certainly keeping a sharp look-out for Andrée. Another expedition, under Lieut. Amdrup, is already exploring the east coast of Greenland from Cape Farewell up to 72° or 73° latitude.

"The only other part left to explore with any probability of finding Andrée is the east coast of Greenland, north of 72° or 73° latitude, and it is to that place that Nathorst is directing his expedition. In this connection it is well to quote Nansen's letter to him on the subject:—

"'The reason why I believe, and always have believed, that the balloon may have been driven towards the east coast rather than to any other land, is its great extent, and the possibility of the balloon having been driven to the west or south-west, in which case Andrée would be almost certain to land on that coast. It should be remembered that if the aeronauts have landed on the polar ice within that circle,[1] they would find the ice in a great part of that area drifting towards the east coast of Greenland, and then I think it is very likely that Andrée, an intelligent, far-seeing man, would at once make up his mind to reach that coast, where he would be sure to meet, in greater abundance than elsewhere, means to support the expedition—seals, walruses, bears, reindeers, and birds.'

"About the 15th of May this year Nathorst's Expedition will start from Stockholm on his own vessel, the *Antarctic*, formerly a whaling steamer, and now in very good condition. It is very likely that the expedition will have to touch at a Scotch or English port on the outward voyage for coal.

"Thence the course will be set for Greenland. There will accompany the *Antarctic* a scientific staff which will find abundant occupation until the middle of July, when we may expect the ice-condition to allow them to get to the land on the coast of Greenland in about 75°.

"There land and boating expeditions will be sent out, both northward and southward, and in the meantime those remaining on board the *Antarctic* will be occupied with all sorts of scientific work. The time at the disposal of the land parties will be about four weeks. Of course, most people entertain the idea that Andrée is lost, but all who know him personally, his presence of mind, his powers of reasoning, and his extraordinary energy, have not yet given up hope. On the contrary, we believe that this summer or autumn Andrée will turn up all right. If our hopes are not realised, at all events some traces of his expedition will very likely be discovered, which will decide the question, and may furnish important evidence of his experiences since leaving Spitzbergen."[2]

Spitzbergen and Kōnig Karl Islands.—The explorations of Mr. Pike in 1897, and Captain Rüdiger in 1898, have already been reported in the *Magazine*, as well

[1] A circle with ten degrees radius from the point where the pigeon was let out.

[2] These notes are drawn from a paper read by Professor Nathorst before the Geographical Society at Stockholm.

as Mr. Bruce's visit to these latitudes. The same year Professor A. G. Nathorst sailed northwards in the *Antarctic*, the vessel which, under the command of Capt. Kristensen, made such a successful voyage to Victoria Land. The vessel touched first at Bear Island, where a landing was effected, and Lieut. Kjellström wandered all round the northern part and mapped it out. The description of the surface given by Professor Nathorst in *Ymer*, 1898, No. 4, agrees with that of Mr. Bruce, but Professor Nathorst states that the highest point of Mount Misery stands 1760 feet above sea-level. Fossils were collected, and geological observations made, which enable Professor Nathorst to compile a history of the island. In the Silurian period the site was covered by sea, in which were deposited the fossiliferous strata containing orthoceratites and other animal organisms, which now form the southern part of the island. These were subsequently folded by the contraction of the earth's crust, and raised above the water. Many thousand years later the sea rose or the land sank again, and in the estuaries a sandstone was deposited with remains of vegetation, forming the present coal-bearing strata, and, as the water encroached still more, Lower Carboniferous limestones and marls were laid down upon them. The land was not totally submerged until the great disturbances of the Permo-Carboniferous age, when there was a deep sea here, in which the masses of limestone with corals, bryozoa, brachiopods, etc., were built up, which now constitute a large part of Mount Misery. Raised again above the water, the island sank once more, when Triassic strata with ammonites were deposited on the bottom of the sea ; these strata are now seen in the summits of Mount Misery. In the Glacial Period Bear Island was entirely covered with ice.

Passing Hope Island, where landing was found impossible, the expedition steered for Recherche Bay, where it stayed three weeks. Lieut. Kjellström surveyed Van Mijen's Bay, which proved to be twice as long as it is represented on charts, while Mr. Hamberg surveyed Van Keulen's Bay by the photogrammetric method. Beautiful prints of fossil leaves were found, swamp cypress, lime, magnolia, etc. In Ice fiord Professor Nathorst had the good fortune to find the first beetles ever recorded from Spitzbergen, a staphylinid and a circulionid.

On July 24th the *Antarctic* left Ice fiord to take soundings in the Swedish Deep, where the Swedish expedition in the *Sofia* in 1868 reported a depth of 2650 fathoms. On leaving Ice fiord it was found that the warm Gulf Stream water extended down to the bottom in 220 fathoms, whereas in 1890 Gustav Nordenskiöld found it only on the surface. On the west side of Prince Charles Foreland the bottom sank rapidly towards the west, soon attaining the nearly constant depth of 1480 fathoms. The maximum sounding was only 1720 fathoms.

On August 2nd the *Antarctic* doubled South Cape, and passed through pack ice to the König Karl Islands. The Swedish Foreland was mapped on the scale of 1 : 100,000 by Lieut. Kjellström. It is a plateau barely 650 feet high, with some lower parts on the southern side. Here Jurassic strata were observed covered with basalt, which forms the surface of the plateau. Bears are very numerous on this island, and seem to live chiefly on grass and other vegetable food. The western part of Jena Island also consists of flat summits, of which one on the northern side is Haarfagrehaugen, named in 1872, and often wrongly placed in maps on the Swedish Foreland ; it is Captain Rüdiger's Emmy Berg, and the truncated cone in Mr. Bruce's sketch, No. 4, p. 120. To the east of the high plateau lies the low central land, where a large quantity of driftwood has collected in the course of ages. In the eastern part of the island stands an isolated flat-topped mountain—Johnsen's mountain. A large collection of fossil plants and animals was collected from ten or eleven different horizons, including belemnites and ammonites. Jena Island was also mapped on the scale of 1 : 100,000, and then

the weather becoming changeable and the anchorage being insecure, a course was steered to White Island, which well deserves its name, being entirely buried under an ice-cap.

In another number of *Ymer* Professor Nathorst has published a paper on this group of islands, accompanied by a map which differs in many particulars from all previous ones. He confirms the statement of Captain Rüdiger, that the Swedish Foreland has a length not much more than one-third of that given on Kükenthal's map, and maintains that Mr. Pike's observations at Cape Weissenfels cannot, as reported, agree very nearly with the position on the Admiralty chart. The position of Cape Altmann was found to be 78° 49′ 31″ N. lat. and 28° 6′ 42″ E. long., and of Cape Weissenfels 78° 41′ 16″ N. lat., and 26° 56′ 30″ E. long. The channel between the islands, Rivalens Sound (Bremer Sound), is much wider than hitherto represented. In Jena Island the bay on the south coast named on Mohn's map Brede Bay, and by Mr. Pike Victoria Bay, is much wider than on the chart. Abel's Island was not thoroughly explored. There seems not to be a fourth island, except a very small islet lying close beside Abel. Mr. Pike, we are informed, saw only three islands.

Professor Nathorst has much to say on the discovery of these islands. The discovery by Edge he discredits entirely. In Purchas's *Pilgrimes*, the land is said to have been discovered "as farre to the Northwards as seuentie-nine degrees," which Professor Nathorst, quite erroneously interprets to mean *extending* northwards to 79°. As to the map, the fact that it shows no land as high as 79° throws doubt on its reliability in other details. Seeing that land actually exists near 79°, where Wiches Land was reported to lie, it seems unreasonably to regard the discovery as an optical illusion, as in the case of Wilczek Land.

Von Heuglin and Von Zeil first reported the existence of a second island distinct from the Swedish Foreland (Jena Island), and to this Professor Nathorst restricts the name König Karl given to it by these discoverers, and calls the whole group Kung Karl's Land, the name given by Professor Mohn in honour of the King of Sweden.

The Belgian Antarctic Expedition.—The arrival of the *Belgica* at Punta Arenas was briefly announced in the May number. We are now able to give further details of its voyage from a letter addressed by M. de Gerlache to the Belgian and Geographical Society, published in a special pamphlet. It may be remembered that the *Belgica* ran aground between Ushuaia and Haberton bay. The only inconvenience, however, resulting from the accident was the loss of the fresh water, which was pumped out to lighten the vessel. In consequence, the expedition had to put into the harbour of S. Juan in Staaten island for a fresh supply. Leaving S. Juan on January 14th, 1898, the expedition made for the South Shetlands, taking seven soundings on the way, the deepest of which, in lat. 55° 50′ S. and long. 63° 19′ W., was 2210 fathoms. Having taken shelter from a storm in the lee of Low island, the *Belgica* sailed on January 23rd towards Hughes gulf, and on the 24th a strait was discovered, "separating from the lands to the east an important archipelago, which we shall distinguish for the present by the name of Palmer archipelago." For an explanation of this statement we must wait until M. de Gerlache's return. Palmer *Land* to the south of Hughes gulf is well known. The "lands to the east" were named Terre de Danco.

The vessel remained in this neighbourhood until February 12th, the scientific staff being employed in taking observations and making collections. On that day the expedition sailed into the Pacific in foggy weather, which prevented them seeing the Biscoe islands. On the 16th the weather became clear, and Alexander I.

Land was sighted, and also part of Graham's Land. On reaching 70° 20′ S. lat. and 85° W. long. it was decided, though the season was far advanced, to enter the pack and make as far south as possible; and 71° 31′ S. and 85° 16′ W. was attained without very great difficulty. Return proved impossible, and the party on board had to resign themselves to a winter in the Antarctic ice. In the second half of March the cold became very severe, with the wind blowing from the south. The weather is determined chiefly by the wind, being clear and cold when the wind blows from the south, while north winds, coming from the open sea, are accompanied by a cloudy sky, frequently fog, and temperature near freezing-point, occasionally even above. The drift is a direct result of the wind, and leads sometimes open out in the pack only to close up again before long. Travelling by sledge was therefore impracticable. In January an attempt was made to extricate the *Belgica* by cutting a channel through the ice, but the channel closed up again under the action of the swell, which, however, itself gradually disintegrated the pack, and allowed the vessel to escape on February 14th.

During the whole winter the *Belgica* was only once exposed to violent pressure, but the impact of blocks of ice set in motion by the swell often gave cause for alarm. The drift during February was very considerable. On emerging from the pack, the *Belgica* was at about 103° W. long., so that it had drifted about 18° towards the west. It is also remarkable that the drift southwards during northerly winds was almost as rapid as the drift northwards with southerly winds. From this circumstance, and the soundings that were taken, M. de Gerlache concludes that the boundary of the hypothetical Antarctic continent on this side should be drawn much farther south. The "appearance of land" (Wilkes) marked on maps at about 70° S. lat., 100° W. long. was not seen.

Not a single fragment of ice was met with on the voyage from the edge of the pack to Tierra del Fuego.

MISCELLANEOUS.

On April 25th the Prince of Monaco laid the foundation stone of an **oceanographical museum** at Monaco.

Mr. Barrett-Hamilton has contributed to *Travel*, for May, a short article on North-Eastern **Kamchatka**. He chiefly deals with the natives, and the article is illustrated with several photographs of the Kamchatkans and their dwellings.

M. Forel has made experiments on the circulation of water within the **Rhone Glacier**, by pouring fluorescin into rivulets descending into it. The results showed that the velocity of the water is normal for the fall and distance, and that therefore there are no basins underneath the glacier.—*Rivista Geogr. Italiana*, April 1899.

In vol. x. p. 604, the gradual sinking of **Falcon Island** was reported. Recently, Admiral Wharton has written to *Nature* (April 20th), that Captain Field of the *Penguin* examined the site in 1898, and found only a breaking shoal. Admiral Wharton believes that the sea in that part of the ocean is able to cut down the shoal to over twenty fathoms, and it will be interesting to watch the progress. Metis Island, seventy-five miles NNE. from Falcon Island, first seen in 1875, has also been reduced to a shallow bank. In 1875 it stood twenty-nine feet above the water, and it was raised by subsequent eruptions to one hundred and fifty feet.

In a letter to Mr. W. S. Bruce **Dr. Koettlitz**, who is with the expedition under the command of Mr. Blundell, gives his route and a few other details. From Berbera

the party passed through Jigjiga and Fiambiro to Harrar. Thence they marched to Addis Abbaba, the present capital of Abyssinia, a collection of primitive grass-thatched huts scattered over a site some four miles square. From Leka, where Dr. Koettlitz's letter was written, the expedition was to make for the Wallega country and Rosaires. A large ornithological collection (300 specimens) had been made. The newspapers have announced the arrival of the party on the Blue Nile.

NEW BOOKS.

The Land of the Pigmies. By Captain Guy Burrows (Captain Commandant, Congo Free State). With an Introduction by H. M. Stanley, M.P. With Illustrations from Photographs, Sketches by the Author, and Maps. London: C. Arthur Pearson, Limited, 1898. Pp. xxx + 299.

It was fitting that Mr. Stanley should contribute an introduction to this book, for it was through him that Captain Burrows, who retired from the army in November 1888 after service in India and Egypt, took service in 1894 with King Leopold as Sovereign of the Congo Free State, to whom his book is dedicated. Mr. Stanley has availed himself of this opportunity to defend the administration and policy of the Congo State, and to refute the opinion that it comes within the category of Lord Salisbury's "dying nations."

Mr. Stanley says that he found this book of Captain Burrows so interesting that he read it through at a sitting. We have been unable to follow Mr. Stanley's lead in this respect in our perusal of the work, but we homologate his appreciation of it and commend it accordingly.

Captain Burrows left England in June 1894, and within a week departed from Brussels for the Congo. He arrived at Leopoldville on the 6th of September, and at Yakoma on the 2nd of November. Leaving Yakoma on the 9th, he arrived at Jabbir on the 26th, "having taken twenty-three days to accomplish what is really a nine days' journey" (p. 45), owing to difficulties of navigation, partly with the rapids and partly with the paddlemen. His original destination had been Meshra-er-Rek by way of Semio, but the Agreement with France had made a change necessary, and Nyangara became his post of duty. After a week occupied in drilling, he moved on with a lieutenant and a hundred men, marching along the north bank of the Welle through forest and occasional open plains, and arrived on the 26th of December at Mbima. He then crossed to the south bank and followed it as far as Siasi. Crossing the river there once more he followed the north bank as far as Bomokandi, one day beyond which he crossed the river again and proceeded along the south bank till he arrived at Amadi on the 19th of January, some 250 miles from Jabbir. He then took to canoes and arrived on the 26th at Nyangara. "The river," he says, "is navigable almost throughout its entire course. There are a few rapids, where portage of goods is necessary, but the boats themselves can travel the whole distance without difficulty" (p. 55).

On his arrival at Nyangara he found the Commissioner of the district making his final preparations before marching against the Azande chiefs in the north. On the 2nd of February they set out in a north-easterly direction, but after a reverse on the 11th they retired to the fortified post of Dongu and arrived there on the 24th of February. On the 28th he was sent with a lieutenant and two hundred men to establish a new post in the territory of the Abangba chief, Kabasidu, six hours south-west of Dongu, in order to supply the Dongu garrison, some 1200 in

number, with food and grain collected from the Mangbattu country. At the latter end of August he was called upon to take command of the Makua district or zone, consisting of the posts Nyangara, Suruangu, and Amadi on the Welle, Pokko on the Bomokandi, and the whole country south to the Rubi and the Nepoko. He held this command till December 1896, when he was ordered home by a doctor after blackwater fever and malaria. When he reached Jabbir on the 28th of January he found the commandant of that district ill and relieved him, holding this command till July, 1897.

This summary view indicates the ethnographic field with which Captain Burrows deals. He journeyed through the length and breadth of it, visiting every chief of importance. But his book is no mere narrative of his itineraries. Having had ample opportunity to study the habits, customs, and rites of the several races and tribes, he describes them in order according to their main characteristics, and introduces here and there, as occasion arises, some noteworthy incident, such as his meeting with Sultan Jabbir (pp. 45, 210-11). It is a book of permanent ethnographic worth in regard to the Azande, Mangbattu and kindred tribes, Mabode, Momvu, Maigo, Mege (or Meje), Niapu, Ababwa, Mobanghi (or Mobenge), as well as the Pigmies of the title. This last is a most interesting chapter. It is in his accounts of the Mabode, Ababwa, and Mobanghi that he adds most to our knowledge. In the case of others his fresh characterisation is often striking and suggestive. Thus, for a sample : "The type of face seen among the Azande is not that of the Negro at all. Even from a European point of view one may find men and women who would pass as very good-looking, for they are light brown in colour, with a clear skin, large eyes, and not very thick lips. The hair, which is curly but not woolly, is worn long by the women, who work it into shapes, more or less fantastic, on the top of the head. There is a touch of civilisation in this custom. Their mouth is totally unlike that of the Negro ; and some faces differ only in colour from that of the European Jew. The race, as a whole, is well knit, healthy, and extremely independent, regarding all other tribes as its inferiors. Above all, these people are extremely clannish. An Azandé is an Azandé wherever he goes, and no matter where he may turn up he is welcomed by his own tribe. His nationality franks him, as it were, and is a sort of masonic badge among his fellows" (pp. 68-9).

We beg to draw attention to his correction of Dr. Parke regarding the Beñge poison, which is obtained, he says, not from the bark, but from the *root* of the plant, *Strychnos Icaja* (pp. 184-6). A chapter is devoted to the government of the Congo Free State, the services, missions, and education ; another to the geology and economic characteristics, and the last to lines and means of communication. There is a glossary of Mangbattu words and phrases. Of the hundred illustrations many are important ethnographically. The work, as printed, has evidently not been finally revised by Captain Burrows, who had left for the Congo before its publication. Hence many of the names are neither correctly nor consistently spelt. There is no map and no index. Maps are announced on the title-page, and a map is needed, say a section of a map like that which appeared in this *Magazine* in February.

Das Republikanische Brasilien in Vergangenheit und Gegenwart. Von Oskar Canstatt, früherem Kaiserlich-Brasilianischen Coloniedirecktor. Leipzig : Ferdinand Hirt und Sohn, 1899. Pp. 656. *Price M.* 12.

This work may appropriately be described as a compendium of information on all subjects of importance relating to Brazil. For its preparation the author

possessed exceptional advantages and qualifications. Having held the post of Colonial Director under the late imperial *régime*, he had at his command official documents of all kinds, while in the course of his official tours he acquired an intimate personal knowledge of most parts of the Brazilian dominions and their inhabitants. He had, moreover, valuable sources of information in several note worthy books of Brazilian travel, such as that of the Princess Theresa of Bavaria,[1] to whom his volume is dedicated, and in the masterly work of Wappäus on the geography and statistics of the country. From the mass of the materials at his disposal our author has made a judicious selection and arranged them in the following appropriate order. Having, in the first place, defined the position and boundaries of Brazil and related the incidents of its discovery, he describes its physical characteristics, the various races by which it is peopled, and the different uses to which the land is applied. Then follow trade and commerce, religion, education and government, the history of the country and a description of the twenty-one States of which it is composed. There is appended besides a statistical supplement.

Brazil is of such vast extent that it comprises about three-sevenths of the South American continent, and has an area nearly equal to that of the whole of Europe. It is conterminous with no fewer than eight different States, with two or three of which it is in dispute on the subject of their respective territorial limits. The magnitude of its area is, however, out of all proportion to the measure of its population, for, as our author estimates, it has only 1·7 inhabitants to each of its square kilomètres. In like disproportion is also its influence in the world either as a political or military or commercial power.

The population consists of Portuguese and other European settlers, of Negroes imported as slaves from Africa, of the Indigens, consisting of 120 tribes mostly Indian, and of mongrels sprung from these races in a great variety of intermixture. The Indigens have gradually been driven back from the coast into the interior, and are now to be found chiefly in the forests of the Amazon and towards the western frontier. Disease, and war with their invaders, have so reduced their numbers that, so far as can be ascertained, they amount to not more than 600,000. The slaves were all emancipated in 1888. Their numbers were reckoned in 1880 to be 1,419,168, but Canstatt takes this to be too low an estimate. He reckons the whole population at upwards of fourteen millions.

The section of the work treating of the discovery of Brazil is of especial interest as bringing to light some new facts ascertained by an examination of the national archives made under the Republican Government. The discovery was made by Pedro Alvares Cabral, who had been sent by the king of Portugal in command of a squadron of fourteen ships to India by the ocean route explored by Vasco da Gama. Cabral, desirous of avoiding the fierce heat of the Guinea coast, steered westward, and on the 23rd April 1500 came in sight of land. He went ashore, but finding the natives, who had come thither in crowds, disposed to be hostile, regained his ships, and after sailing southwards some fifty miles, came to the Bay of All Saints, where he found a haven which he called Porto Securo. Here, on the 1st of May, he erected upon a height a wooden cross, and solemnly took possession of the country, which he had named Vera Cruz, for the crown of Portugal. Next day he resumed his proper voyage, but sent a caravel under the command of Andre Gonsalvo to carry to Lisbon the news of his great

[1] A notice of this work entitled *Meine Reise in den Brasilianischen Tropen* will be found in last December's number of the *Magazine*, where it is praised for the amount of valuable information it supplies regarding the ethnology, botany, zoology, and geology of Brazil.

discovery. The passion for maritime adventure which at that time pervaded Europe glowed with all its intensity in the breasts of the Portuguese, and they lost no time in taking action on the tidings brought by Gonsalvo. Expedition after expedition left the mouth of the Tagus to explore the new world in the direction which had been indicated. The celebrated Florentine geographer, Amerigo Vespucci, who had taken part in the first of these fresh expeditions, went out also in the second in the capacity of its commander. He explored the coast southwards to the distance of some thousand miles, and having then entered the Bay of All Saints he halted for seven months at Porto Securo trading with the natives, from whom he gathered much information regarding the regions in the interior. Here, before he took his departure for Lisbon, he founded a settlement and peopled it with such men of his ships as chose to remain. This was the first of the settlements made by the Portuguese in their new dominions. Bahia, which stands on the east shore of the bay, was founded in 1510 and remained the capital till the seat of Government was in 1763 transferred to Rio de Janeiro. The name of the country was soon changed in the mouths of the people from *Vera Cruz* to *Brazil*, the name of a red-coloured wood which grew in boundless profusion in those parts, and of which an immense cargo was taken to Lisbon by Vespucci. When it became known that this new country had many tempting rewards to offer to the enterprising, it began to attract settlers, of whom the great majority were Portuguese.

The Spaniards, who in those days vied with this people in ardour for discovery, had a considerable share in the exploration of Brazil and the regions immediately adjoining it. Pinzon, one of the companions of Columbus on his first voyage, coasted the northern shores of Brazil and entered some of the inlets of the Amazon. In the south again, Solis was the first to navigate the La Plata, while Orellana, coming in the expedition which Gonsalvo Pizarro was leading from the west in quest of the fondly-dreamed-of Eldorado, reached the Amazon and explored that mightiest of all rivers downwards to the sea. Between the two nations who had taken the initiative in these discoveries the question of *spheres of influence* very soon cropped up, and in 1493 a Papal Bull fixed a line of demarcation which, however, was altered next year to one more westerly and corresponding pretty nearly to the fiftieth meridian of longitude west from Greenwich. All the territories which lay to the east of this line were assigned to the Portuguese and those to the west to the Spaniards. Brazil, which thus fell to the share of the Portuguese, lies mostly within the Tropics, and being everywhere well watered yields in boundless profusion an astonishing variety of vegetable products of which not a few are of great utility and value. The early settlers accordingly, wiser than their rivals on the west, who occupied themselves chiefly in mining for the precious metals, turned their attention to agriculture and the breeding of cattle, for which the prairie lands provided excellent pastures. The chief agricultural products are coffee and sugar, and next in importance are cocoa, tea, tobacco, and cotton. The native tribes do not till the soil, but are content to subsist on the spontaneous produce of their woods and waters. The Brazilian forests have long been renowned for their wondrous beauty and magnificence, and our author in his eloquent and glowing description reveals how deeply his mind had been impressed by these characteristics. They adorn the banks of the Amazon and its numerous tributaries and the hills which fringe the shores of the Atlantic. They are also noted for producing a great variety of cabinet and dye woods, together with an abundance of caoutchouc-trees and medicinal plants.

The historical narrative is perhaps the portion of the work which readers will find most attractive. The thirteen sections into which it is divided take up nearly

a fourth part of the volume. The first of these sections is peculiarly interesting as showing in detail how Brazil was settled, and the same may be said of the last two, the former of which treats of the overthrow of the Imperial Government and the latter of the Republican form of government (mainly modelled after that of the United States) which now occupies its place. Herr Canstatt has adorned his volume with no fewer than sixty-six good illustrations, and also with a couple of useful maps. It is to be hoped that the work which, in view of its accuracy in details and its other high merits, can hardly fail to take its place as one of standard authority, may soon be reproduced in an English translation.

Round the World on a Wheel. By John Foster Fraser. London: Methuen and Co., 1899. Pp. 532. *Price* 6*s.*

Mr. Fraser has produced a very readable book, and all the more so as he recognises his limitations. He does not think because he has cycled across India that he is in a position to settle all the grievances of Hindu and Mohammedan, or because he has been in China that he can instruct Lord Salisbury upon the question of the open door.

He describes people and things as they were seen by the eyes of an intelligent but speedy traveller, and having an experienced pen, he is able to convey graphically the impression which the different countries made upon him. The tamasha at Calcutta, the interview with the Buddhist "archbishop" at Mandalay, the forty-mile ride through the snow-shed of the Sierra Nevada, and the characteristics of Chicago, are recorded in varied and interesting styles. But unfortunately it is in the lesser-known countries that the vividness of the story is least conspicuous, a fact probably due to the monotony of these roadless lands. Ordinary cyclists will be interested to notice the rarity of reference to winds. Nothing short of a hurricane seems to have been observed by the three mighty ones. The author makes good use of the Shakespeare which formed his travelling library, but the attempt on page 7 to make a quotation from Coleridge is not a success.

Kreta in Vergangenheit und Gegenwart. Geschildert von H. Bothmer. Leipzig: Woerl, 1899. Pp. 104. *Price* 2 *mark.*

One of Woerl's Guide-books, this volume is by the Dragoman of the Turkish Embassy in Berlin. It is amply illustrated, and contains an excellent map of Crete, an island which has lately attracted unusual attention. From St. Paul's days, the Cretans have not borne a very good character. Let us hear what their latest critic, Herr Bothmer, says of them :—"The Cretan is a stubborn, independent fellow, eyeing strangers with suspicious reserve. Being an islander, one would have imagined him to be by nature a bold and enterprising seaman, but the truth is that the peculiar structure of his island, with its secluded glens, has bred in him that love of home which in a much less degree the Swiss display. Disunion and mutual distrust, occasioned by the sharply opposed Mohammedan and Christian faiths, check progress and prosperity." The author states that the Cretans are a very mixed race, the aborigines being, however, not of Greek but of Pelasgic-Semitic origin.

New Climbs in Norway. By E. C. Oppenheim. London: T. Fisher Unwin, 1898. Pp. 257. *Price* 7*s.* 6*d.*

Mr. Oppenheim is to be congratulated on having brought a new field to the notice of climbers. In the Sondmore district of Norway, within a few hours by steamer of Aalesund, he has discovered a peninsula which is a small paradise to true mountaineers, and in which, even after his visit, several virgin peaks remain. It is "a very mine of wealth for the climber." He tells his experiences with fresh-

ness and enthusiasm, and with all directions which he thinks may be of service to future climbers. But it would have been well had the results of his explorations been made available in the form of a sketch map, for the Government map is frequently mentioned as unreliable. It is not easy for a reader even to grasp the general positions of the different points. The book is well printed, and is illustrated by Mr. A. D. McCormick.

Physical Geography. By William Morris Davis, Professor of Physical Geography in Harvard University; assisted by William Henry Snyder, Master of Science in Worcester Academy. Boston, U.S.A., and London: Ginn and Company, 1898. Pp. xviii + 428. *Price* $1.25.

A new book by Professor Davis is always a matter for rejoicing, as one can be certain of finding fresh and suggestive treatment of the subject. This present book is no exception to the rule, and is of special interest in that Professor Davis has here given an outline of his views on the forms of the land, their causes and their consequences, such as he considers suitable for schools. It will be welcomed by all geographers, and especially by teachers of geography. We advisedly say the book is one dealing with the forms of land, because the Earth as a whole, and its oceans of water and air, are dismissed in the first ninety pages, which, however, contain an excellent treatment of the winds and ocean currents.[1] There is a hesitancy in this part of the book in introducing the full explanations, which are, however, partly found in the appendices, that is by no means characteristic of the principal part of the work. We think pupils who are fit to make use of the last three-quarters of the book could profit by a fuller and less elementary treatment of the atmosphere and oceans than Professor Davis gives them.

Most works on Physical Geography written in this country take the physiological rather than the morphological point of view, and discuss the forces at work on the Earth's surface and their results. A work adopting the morphological point of view is therefore a gain to all accustomed to the other. Luckily geomorphology in Prof. Davis's hands is not the analytical description of dead forms, by a repellent and overloaded terminology which gives words instead of explanations, such as is still current in much biomorphology. We have here a work by an evolutionary morphologist concerned with the development as well as with the classification of forms, a work not merely analytic, but synthetic, always pointing out the connection between the forms described and other things.

The chapters dealing with the land are treated from an evolutionary point of view. The narrow coastal plain and its gradual widenings and dissections are first discussed; the consequences of relative uplift or depression are dealt with; and this is followed by a discussion of ancient coastal plains, which naturally leads to the problems of plateaus and their dissection.

The next chapter deals with mountains, discussing the block mountains and various stages of *dissection* of folded mountains, their *subdued* and *worn-down* forms, and ends with a study of the coast-line formed by *embayed* mountains.

The next chapter deals with volcanoes and earthquakes. Rivers and valleys are treated with a fulness not usually found in an elementary book, and their life-like behaviour is insisted on. *Revived*, *antecedent*, *engrafted*, *dismembered*, and other types are explained with abundant illustrations.

Chapter x. deals with the waste of the land, the formation of flood plains and deltas.

The next chapter deals with the climatic control of land forms, and is partly physical, partly biological, and partly anthropological.

[1] See Professor Davis's article on these subjects in the *Magazine* for October 1897.

The last chapter discusses the shore-lines and their development along the border of the land.

It will be seen that we have in this book a *résumé* of the best American work on the morphology of the land, to which Professor Davis himself has been one of the chief contributors. As a discipline for advanced students this morphological treatment is extremely valuable, and for the geography classes in our training colleges and universities no more suggestive text-book on the subject has yet been written. It is one, too, that every teacher of geography will buy because of its freshness, concreteness, and clearness of treatment.

Not the least valuable part of the book is the large collection of diagrams of earth-forms in the solid, the study of any one of which is a good discipline in itself. The small maps and the ordinary pictures of scenery are all admirably chosen, but one scarcely sees the use of the majority of the typed maps of the continents appended to the work.

Considerable effort is made to precise nomenclature. A number of terms have been introduced new to elementary works in physical geography although well enough known in the papers of Professor Davis and other American writers. Some of these are convenient shorthand expressions for well-known forms, but in one or two cases they are not quite happy, as the use of *cuesta* for the solid formed by escarpment and dip slope, *monadnock* for the isolated hill or ridge remaining above the level of a denudation plain, *graded* for a river where no grades are left. Some terms are most objectionable, for instance, *lengthwise* (adverb!) valley for longitudinal valley, *crosswise* for cross or transverse valley, and *branch* for tributary.

While the book will not perhaps be introduced to many schools in the present condition of education, it may be regarded as a pioneer work which will be more and more used in the highest classes of our high schools as the study of realities more and more replaces gerund-grinding.

Grundzüge der Pflanzenverbreitung in den Kaukasusländern. By Dr. Gustav Radde, Director of the Caucasus Museum at Tiflis. 13 Figures in the text, 7 Photo-engravings, and 3 Maps. Leipzig: Wilhelm Engelmann, 1899. Pp. xii + 500.

This is the third of a series of monographs on the Vegetation of the Earth now being prepared under the editorship of Professors Engler and Drude. The objects of the series have been already pointed out in a review of Professor Pax's work on the Carpathian Vegetation.[1]

Dr. Gustav Radde, the author of the present work, has for the past forty-seven years occupied himself in exploring Russian territories; at first the Crimea and East Siberia, but since 1863 he has concentrated his attention on the region of the Caucasus mountains, until there are few of their ridges and valleys which he has not traversed. As a mark of the high esteem in which he is regarded, the Russian Geographical Society has this year awarded him its Constantine Gold Medal.

His former voluminous writings on the same region, scattered through many magazines and in various languages, are co-ordinated and summarised in this work, presenting the most complete account of the plant life of the Caucasus yet prepared, and one well-nigh exhaustive in extent.

After an introduction on the bibliography of the subject, a chapter is devoted to each of the five main vegetation regions—the steppes, the forests, the subalpine, alpine, and glacial regions. The extent and constitution of each are fully dealt with, and careful consideration is given to the climatic and soil condition determining each association. The marked attention which has been paid to the

[1] See *Scot. Geog. Mag*, xiv. Aug. 1898, p. 440.

phenological relations of the Flora is of the greatest interest and value in correlating the climate of this region with that of the adjacent lands.

The author has carefully studied the natural subdivision of the territory; his chief divisions are given in the following table:—

I. Steppes.
  1. *Low Steppes.*
    (*a*) Sand Steppes, found chiefly on the north-west coast of the Caspian Sea, and mostly under sea-level.
    (*b*) Halophyte, *Chenopodium*, and *Artemisia* Steppes, on soils impregnated with salt; in many of the valleys and extending in some places as high as 1220 m. above sea-level.
    (*c*) Humus Steppes with *Stipa*.
  2. *High Steppes.*
    (*a*) Transition region, characterised by spring Liliaceæ, Cruciferæ, Borragineæ, etc.
    (*b*) *Stipa* Steppes, in the region of the sources of the rivers Aras and Kura, on dry, stony, or calcareous soil, at altitudes between 1220 and 1830 m.; characterised by *Stipa Szovitsiana*, or by *Andropogon Ischaemum*.
    (*c*) Oriental Steppes, from the highlands of Iran westwards to the summit of the Armenian plateau; marked by the families Leguminosæ and Labiatæ.

II. Woods.
  1. The Colchic (Pontic) coast region, whose affinities are with the Mediterranean region, with evergreen shrubs such as Box, Cherry Laurel, and *Rhododendron ponticum* as dominant vegetation.
  2. The Talysch region on the south-west coast of the Caspian, with woods of deciduous trees of a southern nature.
  3. The remaining woods, scattered in more or less isolated groups along the chain of the Caucasus. Here many of the northern trees such as Beech, Oak, Scots Pine, and Birch occur, mixed with others of more restricted range. The limits between which these trees are found on the mountains have been carefully determined.

III. Subalpine Zone, from 1830—3050 m., and characterised by *Rhododendron caucasicum*.

IV. Alpine Zone, from 3050—3660 m. on the north side, but beginning as low down as 2740 m. in the south-west part.

V. Glacial Zone.

The lists of plants are more clearly arranged than in the earlier works belonging to the same series, and the maps are of considerable value, the only blemish we have noted being a want of correspondence between the colours of the third map and of the accompanying key, which has arisen from printing the colours determining the regions of vegetation over the shading indicating elevation. Difficulty in the precise reading of the map is the result. The photo-engravings are excellent, and make it possible to realise very graphically the physiognomy of the region. The editors and publisher are to be congratulated on this important addition to their series.

Pocket Guide to Paris. Conty's Practical Guides. Paris: Conty's Guides Office, n.d. *Price 2s. 6d. net.*

Conty's Guides have a large sale in France, probably suiting the taste of the French people, with their numerous small illustrations. The present volume, which seems to be the first published in English, contains as much information as is required by the ordinary sight-seer, and is conveniently small in form, and would be still smaller were the numerous pages of advertisements omitted, to which, moreover, the tourist is directed for the names of hotels—a very small list For places close to Paris, such as Versailles, Sèvres, and even St. Denis, he must purchase another volume.

NEW MAPS.

EUROPE.

ALLEMAGNE. Atlas Universelle de Géographie. Ouvrage commencé par M. Vivien de Saint-Martin et continué par Fr. Schrader.

Librairie Hachette et Cie., Paris.

The latest map of this atlas is a topographical map of Germany on the scale 1 : 2,500,000, with an inset showing Berlin and its environs on the scale of 1 : 200,000. Like the other sheets it is carefully compiled and executed ; if there is anything to find fault with, it is a slight haziness in the colouring.

ASIA.

CHINE MÉRIDIONALE ET TONKIN. Par le Capitaine Friquegnon de l'Infanterie de Marine. Échelle au 1 : 2,000,000.

Service Géographique des Colonies, Paris.

This map represents the southern part of China from Nankin, Kuei-chow and Tsiamdo down to a little south of the latitude of Luang Prabang in Tonkin, together with the adjoining parts of the British Shan States. It is very full of names, and shows roads, railways, telegraphs, as well as boundaries of provinces, tribes, chief towns, etc. The execution is also good.

AFRICA.

BONCLE DU NIGER, Carte de la ——. Dressée par le Lieutenant Spicq. 2e édition. Échelle de 1 : 1,500,000. 1898. 2 sheets.

Service Géographique des Colonies, Paris.

This is a second edition of the map noticed on p. 168 of vol. xiv. Since the first edition was published, several French officials have surveyed various parts of the country, and their observations have been made use of in the present map. The northern boundary of Togoland has been inserted, but not those between the British and French territories on the Niger basin and the hinterland of Ashanti.

WAKIMBULANDE, Hauptmann Prince's und Lieutenant Stadlbaur's Reisen im ——. Konstruirt und gezeichnet von R. Kiepert und M. Moisel.

NYASSA-SEES, Karte der Reisen des Bergassessors W. Bornhardt im Nordwesten des ——. Von P. Sprigade.

UHEHE, Routen in nordwestlichen —— und von Idunda zum Nyassa-See. Aufgenommen von P. A. Adams, O.S.B. Reduzirt von Dr. R. Kiepert.

TOGO, Karte des Nördlichen Theiles des Schutzgebietes —— und seiner Hinterländer, konstruirt und gezeichnet von P. Sprigade. Massstab 1 : 1,000,000.

RIO DEL REY UND CROSS RIVER (MANYU). Das Deutsch-Englische Grenzgebiet, zwischen ——. Von Dr. R. Kiepert und M. Moisel. Massstab 1 : 150,000.

Mittheilungen aus den Deutschen Schutzgebieten, Bd. xi., 1898.

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Steppe
Mugan
Steppe
Karabakh
Steppe
Makhmud
chala
Saluan
EXPLANAT
Fore
Gras

SEA OF AZOF
BLACK SEA
CASPIAN SEA
MOUTHS OF THE VOLGA
Steppe of the Kalmykhs
Steppe of the Kara noguitsi
Western Manych
Eastern Manych
Sasto Lakes
Kuma
Manych
Don
Sal
Kuban
Terek
Sulak
Kura
Araxes
Rion
Mingrelia
Abkhasia
Imeritia
Karthalinia
Kakhetia
Daghestan
Georgia
Armenia
Shirvan
Karabagh
Gudur-dagh
Shakh-dagh
Babu-dagh
Kara-dagh
Bingol-dagh
Palanteken dagh
Lake Van
Armenian Taurus
Fontane
Alagos
Ararat
Lesser Ararat
Bergushet
Kasbek
Elbrus
Tebulos
Donos
Farbalo
Pogos
Akhalzikh
Trialety Mts
Bekobad Mts
Mashavera
Ganzhi
Karayaz
Kamarli
Kasakh
Shamkor
Elisabethpol
Tiflis
Baku
Apsheron Pen.
Salian Pen.
Lenkoran
Derbent
Kuba
Shemakha
Akh sybir
Mallumi
Bazar duzi
Sharur Steppe
Muran Steppe
Muzkhet
Kazbek
Kobi
Gudaur
Mamisson
Zekari
Khada
Kvirila
Rion
Tskhenis-tskali
Khrami
Debeda
Alazan
Iora
Kura
Araxes
Aghstafa
Kasakh
Shamkor
Karayaz
Ganzhi
Mashavera
Bekobad
Trialety
Akhalzikh
Fontane
Chorokh
Soghanlu
Sarikamysh
Kars
Kars-chai
Arpa-chai
Aras
Araxes
Eastern Euphrates
Murad-su
Mush
Bitlis
Van
Tabriz
Urmia
Maragha
Ardebil
Salmas
Khoi
Nakhichevan
Ordubad
Julfa
Meshkin
Sabalan
Savalan Mts
Kara-dagh
Lenkoran
Kuba
Derbent
Gudur-dagh
Shakh-dagh
Babu-dagh
Akh sybir
Mallumi
Bazar duzi
Sharur Steppe
Muran Steppe
Muzkhet
Kazbek
Kobi
Gudaur
Mamisson
Zekari
Khada
Kvirila
Rion
Tskhenis-tskali
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Alazan
Iora
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Araxes
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Shamkor
Karayaz
Ganzhi
Mashavera
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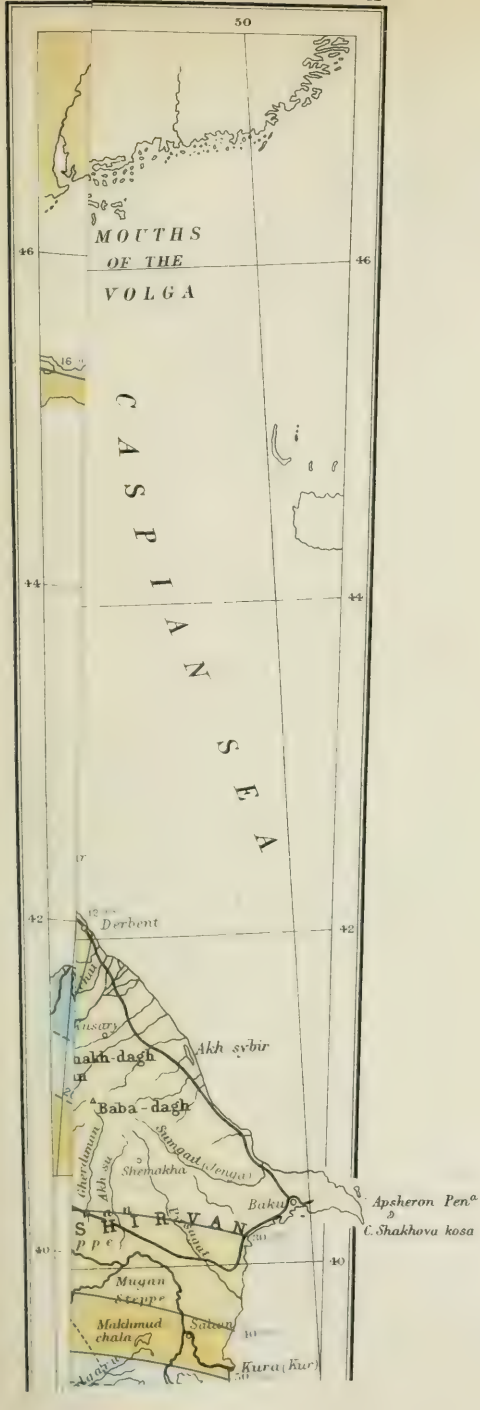
Kars-chai
Arpa-chai
Aras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MOUTHS
OF THE
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CASPIAN SEA
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Derbent
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C. Shakhova kosa
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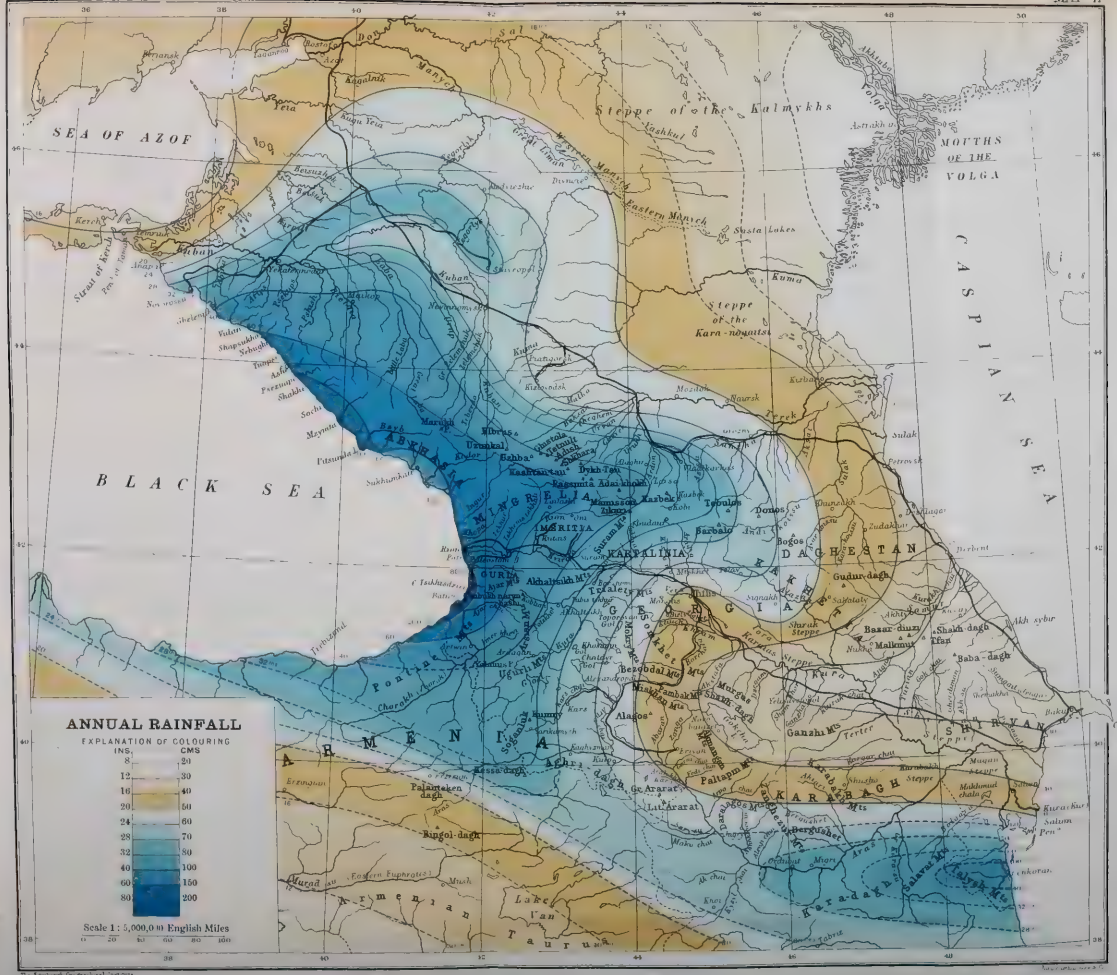
Steppe
Salyan
Kura (Kur)



ANNUAL RAINFALL

EXPLANATION OF COLOURING

INS.	CMS
8	20
12	30
16	40
20	50
24	60
28	70
32	80
40	100
60	150
80	200

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

ALBANIA AND THE ALBANIANS IN 1898.

By the Rev. Hugh Callan, M.A.

Albania seems always to have been what it is now, the home of a sturdy, fearless race of men. It is a "land of the mountain and the flood"; a land of ancient customs, ancient garb, ancient feuds; a land of clans and tribes, each embittered against the other; a land of individualism, where the social instinct is smothered by the right and might of each unit to do as it pleases. Its position and configuration are such that a race once in it can defend itself against absorption by any invader. On the east it is bounded towards Macedonia and Thessaly by a line of mountains (Scardus and Pindus) and some large lakes (Ochrida, Presba); on the south by the highlands of Greece and the Gulf of Arta; on the west by the boisterous Adriatic, a long line of inaccessible cliffs (Chimara or Acroceraunia), and long low dangerous shores with swampy strips behind (from Valona up to the Gulf of Drin); on the north by Montenegro and Novi Bazar (with mountains going up to 8000 and 9000 feet). The interior everywhere is mountainous, with small plains and valleys between, each usually containing a considerable town. Communication is impossible except over the high intervening passes.

If you can imagine Scotland all highlands and no lowlands, with the average height of the land 2000 feet instead of (say) 1000 feet, with mountains going up to 7000 and 8000 feet, instead of to 3000 and 4000 feet, you have an idea of Albania physically, and if further you can conceive of all Scotland being what the Highlands were in the time of Columba, you have an idea of Albania's present social condition.

Although the inhabitants do not call themselves Albanians, but *Skipetars* (mountaineers), and their language *Skip* (pron. *Shkyp*), there seems no doubt that Albania is the older term. The root *alp* seems to afford some clue to their ethnological connections. We have it in

Western Asia in Albania (classical) of the Caucasus, and in Western Europe in Albyn, Albany (the old name for Scotland, or North-eastern Scotland), and also in Italy in the various towns called Alba, in *Mons Albanus*, *Lacus Albanus*, and *Alba Longa*, of the Romans. The latter was the most ancient town of Latium, and may have signified the "long mountain town," as much as "the long *white* town"—for *alp* may radically mean *white* or *snowy*, just as Himalaya and χεῖμων, *hiems*, are connected. At any rate, all the words with *alp* or *alb* are associated with the idea of "mountain," and go back to antiquity. Some of the Pictish tribes called themselves *Albanich*. In modern Albania the town called Elbassan was once called *Albanon*, and it is in the central mountainous district, containing the purest and finest tribes. There is a village, containing a fine set of people, called *Albochori* (*alp* and χώριον, a place), situated 500 feet up a mountain which overlooks the remains of the Pelasgic city of Dodona, 9 hours south-west of Janina. It may have been so called "the mountain place" in contradistinction to Dodona in the valley.

One cannot go far in the study of origins in Albania without striking on the Pelasgic problem: "What were, and what has become of, the Pelasgi?" That they forefathered much of ancient Greece seems certain, that they were a superior race with a distinctive civilisation may be inferred from the numerous existing architectural remains known as Pelasgic, and that they coalesced with other races as time went on seems evident from the few notices of them in historic times.

Now, it is held, by the few educated Albanians who are competent to look into the matter, that the bulk of the Pelasgi settled in Albania, and that the best tribes of Albania are their descendants. I share in this opinion, which local traditions go to confirm, and which would go far to explain the unique distinctiveness of the Albanian people and language. In Central Albania there are many villages or groups of villages on the mountains resolutely keeping themselves apart, and the people are fine specimens of humanity, exquisite in mould, with finely chiselled features, open brow, long eyelashes, straight nose, perfect mouth, pencilled like Cupid's bow, and of noble yet quiet natural bearing. Moreover, on inquiry of them as to who held the land "in the old old times," I was told "the *Pelëkhĕ*," which is surely Pelasgi. I also find it quite a common conviction that an important people in pre-Roman times fixed most of the existing sites of places and ruins. For instance, a small church at Durazzo (called now San Giorgio, but formerly Santa Lucca), the entrance of which is 3 feet below the present surface, and the foundations as much again, is locally believed to have first been built by the *populo gentile*, by which term seems to be denoted something more than the Patristic sense of "all not-Christian," but rather "gentle, civilised."

A likely hypothesis regarding the Pelasgi is this:—Following the sun through Thrace and Macedonia (where as in Asia Minor they created areas), they came into North Albania, and finding the sea a bar to their farther progress west, turned southward (the mountains that way being lower than towards the north), then leaving contingents as they went, settled about Lake Pambotis (Janina), where a new sort of country con-

fronted them, and thence sent various incursive waves into Greece proper. There can be no doubt that Southern Albania (especially Molossis and Thesprotis, with the great Pelasgian centre, Dodona, in their midst) was the seat of many tribes who eventually became Greeks—*e.g.* the Thessalians and the Dorians. Another and a finer civilisation was developed in the towns and lowlands of the south (Greece proper). It is to a type of an earlier world than his own, but yet by implication co-existent with his theme (the tribes of Greece and the Trojan war), that Homer refers when in *Il.* xvi. 233, Achilles appeals to "King Zeus, Dodonean, Pelasgian, dwelling afar, guardian of wintry Dodone, and round thee are seen the Selloi, who do not wash their feet, and sleep upon the ground."

It is quite clear that the Dodona district was Pelasgian, and it seems also equally clear that the name of *Hellas* originated there. The *Selloi* are called *Helloi* by Pindar, and the district *Hellopia* by Hesiod, and Aristotle affirms that these *Selloi* had as neighbours a people called "*Graeci* now known as *Hellenes*." At any rate there to this day are the vast Pelasgic ruins (resembling those elsewhere—*e.g.* at Mycenae) of Dodona—answering to all the scraps of information we possess about it—the ilex groves, the falling water, the jutting point of land on which the temple of the oracle stood, and the fertile land about it. There, too, we find the strange natural phenomena of sinks or *καταβόθρα*, which convey the waters of lakes (*e.g.*, and chiefly, Janina) having no other outlet, beneath the ground to reappear elsewhere as rivers (three being still traceable, Thyamis, Cocytus, Acheron), which gave origin to the great mythological idea of Hades and the under-world. Surely the Pelasgi must have been in a position of pre-eminence either in mental force or in numbers to have thus imprinted on the whole Grecian world their own local religious conceptions!

Whether, however, the Pelasgi are the true ancestors of the Albanians or not, this at least seems sure, that these must have remained unchanged for thousands of years, as they remind one more forcibly of early Greek descriptions of life than any other existing race. The system of guest-friendship, the grouping of the land into districts under hereditary chiefs, the dress—*fustinella*, tunic, sandals, and leggings, formed of strips of hide crossed—the shepherds' hairy cloaks, the huge sheep dogs, are all suggestive of ancient descent.

Having been left to themselves while all around has been changed, the Albanians have no history (strictly speaking) to boast of, but that does not mean that they are either a quiet or an unimportant people. Quite the reverse; they have never been properly subdued, and are for ever in strife among themselves. Internecine feuds—one village or clan, or one division of a town against another—murder, robbery, and pillage go on daily. A gendarmerie sergeant up in the interior told me that sometimes for days and nights together he never has off his riding-boots, so frequent are the disturbances—as often as not ending fatally—in the district demanding his attention. Often when sitting quietly in a house conversing with some local men in a town, we would suddenly be startled by the firing of a shot, then another farther off, and others at intervals. "What is it?"—"Ah, some poor fellow finished! That cursed blood-feud!"

Such being their condition of life, they are far from proving amenable to Turkish rule, except that they are proud to go whenever called to fight victoriously for the Crescent. They laugh at Turkey, and where they dare not, they hate and sullenly submit. Were they not so hopelessly divided, they could achieve their independence in a year. It is a knowledge of this fact (coupled with admiration of the good success of British administration in Egypt) that has lately induced a number of Albanians who have thriven abroad to approach our ambassador at Constantinople in the hope that something may be done to raise the condition of Albania, while still remaining Turkish. As they say and write, "We distrust Austria and much more Russia; it is the help of your great and just nation we implore. We stretch our hands across the sea."

There are three methods by which we may attempt to classify the Albanians—(1) dress; (2) religion; (3) race. So varied are their costumes that (1) dress appears a natural distinction. But there is a good deal of intermingling even in this, according to the districts. The *fustinella* predominates towards the south among all classes, peasants and proprietors; in the north it usually indicates the better-class native, proud, haughty, "the wild Albanian kirtled to the knee." The other characteristic costume is that adopted most generally by the peasants in North and Central Albania, and consists of grey homespun from head to heel, jacket and close-fitting trousers braided with black, white fez or skull-cap, or scarf going round the head and tied under the chin, ox-hide sandals (*opunkas*), sash and belt round the waist bristling with yataghan and pistols, and usually a long gun slung over the shoulder.

In the towns the trading classes, whether Roman Catholic, or Greek, or Mohammedan in religion, usually wear the fez, baggy silk trousers tied below the knee, white socks and elastic-sided boots or coloured gaiters and shoes, or dress in the European fashion.

The women's dress varies greatly. Some have one coarse garment, drawn in at the waist, and go bareheaded and barefooted; some, a tight jacket, open in front, and thick short petticoats; others, and more commonly, a simple skirt, met at the knee by a sort of thick gaiters, leather bands round the waist, a little black shawl on the shoulders, and a richly hued shawl or kerchief swathing the head. Most of the townswomen dress either in the veiled Turkish style or in European style.

As to the other method, (2) religion, we might say they are mainly Roman Catholic in north, Greek Orthodox in south, and Mohammedan in central Albania; but, considering that out of an estimated population of $1\frac{1}{2}$ millions, only half a million are Christians—the one million being Mohammedan, at least nominally—we cannot accept this method, even though Lord Strangford advocates it.

There remains, then, the old and only true method, (3) that of racial or tribal difference. The Gheghes in the north are quite distinct in appearance and manners from the Toskhs in central and part of southern Albania—the former being dark, the latter fair in complexion. Between them they hold what is purest and oldest in race. There are also (to the south of the Toskh country) the Liaps and the Dzhams—

coarser, weaker, more civilised perhaps, mostly speaking (Romaic) Greek.

But, on the whole—excluding some repulsive types to be met with here and there both north and south—wherever they are and whatever their speech, dwelling in wild eyrie-like hamlets perched on precipices or in snug towns on fertile plains, the Albanians give you the impression that they are of a noble and ancient race, physically and psychologically, both men and women, a credit in point of health, strength, and beauty to humanity. The Albanian has been maligned because he has not been known. He is fierce, reckless, revengeful—but truthful, faithful, virtuous, hospitable. He has the quickness of the Greek without his instability; the solidity of the Slav without his boorishness.

I cannot deny that it is dangerous and dreadful to travel in Albania. But with all the outcry of danger, brigands, and of disbanded but not disarmed soldiers going about starving and marauding, I state the fact that I went through it all—including some of the wildest parts not hitherto visited—with no other weapon than my riding-switch, and often with no other guard than my native follower, also unarmed—and that without molestation.

It augured ill for my journey that the Turkish authorities were very sullen and slow at Durazzo, where, moreover, I was well known from previous visits. I found myself ominously a suspect. You see, the Russian consul from Scutari had been up the country recently backing the native (Greek) Christians against the Government, and disturbances had been frequent. The very day I arrived the Bey of Tirana had been shot dead by a man whose privacy he was invading, and the authorities durst not touch the murderer. It being allowed that a Turkish passport (*teskereh*) was essential to my protection in the interior, every pretext was seized upon to put me off. First, a change of governors (*mutesarif*) was going on: the late one could not grant it, and the other one had delayed his arrival. When he came, he pleaded illness, then his wife's death. Then his next-in-office, when applied to, "could do no business, being in mourning for his uncle." However, a few telegraphic messages, strongly worded, altered the situation, and I got "orders to go everywhere, with guards if wanted." That's the way with the Turks: a dead wall, nothing! when once the right wire has been pulled, everything, more than you want! Then my man required his passport, but as he was poor, and was in arrears with his taxes, he could not obtain it. By the law he could not quit the town. So they had recourse to a legal figment. His legal shadow, the poor Turkish debtor, remained behind in Durazzo, while his real substance, as my servant, and *pro temp.* a British subject, went with me on horseback and through Albania, was finally smuggled across from Previza to Greece, thence *viâ* Corfu returned to rejoin his wife and family and legal shadow at Durazzo.

While waiting I explored the long, isolated (separated from the mainland by a wide salt swamp, on which the Government carries on salt-panning) ridge, on the south end of which Durazzo lies. Its height averages from 300 feet to 600, length about 6 miles, soil argillaceous, beautiful clay of many tints, from dull grey to bright orange. The sea

has encroached, revealing traces of Roman brick-kilns and terra-cotta remains in layers several yards below the present surface. Solid walls of very fine seaweed, from 5 feet to 15 feet high, are piled all along the shore. The northern part contains quartz on the top and vast conglomerate heaps below. That the whole seaward slope was once a *Campagna Romana*, the thick copses, where now foxes, hares, and weasels make their dens, crowded with fruit-trees and plants, all degenerated to their wild state (vines, figs, apples, asparagus, phlox, sweet-william, and many such, especially about a beautiful hollow called *Calmi*, with an immense fig-tree in the midst), testify at this day.

Starting from Durazzo eastward, our path the first day went over a series of low sandy hills, with long stretches of reedy marsh between, then along the bed of the river Arsen, and up on to a fertile plain covered with flocks, through deep woods of olives and abeles, up to 500 feet. Judged by the various hamlets and khans and by the red-tiled houses peering out amid the woods, this district seems prosperous. Half of the peculiar picturesqueness of Albanian scenery is due to the deep yellow or brown of the soil, contrasting with the light green of vegetation. We came out on to a plain at right-angles to our course, running from Tirana north-west to the Drin Gulf, with the town of Kroia on the east, 2000 feet up a range 5000 feet high—an impressive sight, with its walls and palace up on the precipices. We passed a row of tall poplars, at least 500 yards long, and found ourselves among the planes and cypresses and minarets of Tirana, lying at the foot of Mount Daiti (5000 feet). A city of waters, runlets along the middle of the cobble-paved streets, with bridges crossing; a city of houses amid gardens, of mosques and graveyards, of enclosures containing sweet streams and cypresses (80 to 100 feet), and plane-trees (6 to 10 yards in girth); of wonderful costumes of Gheghes men and women coming and going and pressing in the narrow slippery lanes; a city of great markets, where hundreds and thousands of horses and donkeys and oxen crowd all the open places, and fruits of all kinds, melons, bamyas, patiljans, pepper-pods, onions, and small ware of all sorts, tins and pots, mirrors, combs, soap-cakes, and trinkets are spread out on carpets for sale; while over all the glorious shapes of clouds, arrested by the proximity of a mighty mountain range, lie in deep rosy beds filled with the sun; the cicalas in countless multitudes whir their monotones in every bush and tree, and the cuckoos call from grove to grove—such a place is Tirana!

To get to the next city, Elbassan, we had to cross perhaps the stiffest pass in Albania. First, we cross a low range (500 to 600 feet), with heights above, on one of which (to the west), around a castle, there lives what is said to be the purest and oldest tribe in Albania. Then we rejoin the Arsen in a deep ravine, with the cliffs rising abrupt on either side. Here we crossed eight times at least within half a mile, wading or swimming our horses. A sort of path exists, up and down the banks, sometimes rudely paved, always deep in mud, often as steep as a house roof. The rocks in the river bed are whinstone, in the ravines yellow sandstone, while the prevailing character of the mountains east and west, dark red in colour, seems ferruginous. The few

villages are so suited to the soil, and so buried among woods, that one can hardly detect them. The sweet sandy lanes are gay with heaths, thistles, campions, geraniums, nipplewort, calamint. At 950 feet (temp. 65°) there is a khan called Čafkhrab, under a village called Skuteh. Beyond this we leave the valley of the Arsen (which here trends eastward) and ascend the Khrab mountains. The path twists up among huge jutting blocks of rock and prickly *Paliurus* bushes (where one is bruised and scratched all over) up across a vast bare sloping wall of shale and whin (where a thunderstorm burst, making the horses start and risk a fall down the unbroken slope for 500 feet, and as much again sheer below that). At 2000 feet we pass a guardhouse (two soldiers) and begin at once to descend, abruptly, leading the horses. We come to a melancholy wood, with bleached trunks of trees, a mossy fountain, a grave or two of murdered travellers; then up and down again over three eminences 1200 feet high, among the glorious red soil and the shining patches of quartz by giddy slippery paths into the valley of the Zaranika. Down past streams and dams and mills, and men and women shepherding, into lanes bordered with tamarisks and wild vines, and on over the broken causeway (*selciata*) through olive groves and grassy meads, and out on to the wide plain of the Skumbi, with vast Tomorhit and its triple crests towering away to the south, a glorious purple vision.

Elbassan is very Mohammedan—population 12,000, very few being Christians. But if my host, Hassan Dommi Effendi, is typical, no Christian can have much to complain of. The humanity of the Turkish system is well seen in its tolerance of the lower creatures. Daws and jays wheel about the old clock-tower and the tin-plated minarets in flocks; turtle-doves sit and coo on the branches of the grand old mediæval cypress-trees. As Hassan said, "The poor here are oppressed, but it is bad men, bad Turks, who only wish to enrich themselves, do the big, and go back to Constantinople, who are to blame, not our religion, nor our good Sultan (Inshallah)! If we had only schools here, the people are naturally so bright and intelligent that they would soon surpass all their neighbours." It is the case that there are no national schools in Albania, very few of any kind, and only in the bigger places a Roman Catholic or Greek Orthodox one, to which, of course, Mohammedan children cannot go. Elbassan is very picturesque in its streets and situation, and very rich in types of physiognomy. The finest tribes make this their market town. Any day you can see crowds of hill people trooping in and out, their splendid physique and serious demeanour contrasting with their appearance of extreme poverty. Tall, lithe, big-boned, strong-nosed, high-cheeked men and women, with large liquid dark eyes, long eyelashes, dark hair, are the rule. Some rude repulsive types are noticeable, but no weak faces. Some women have absolutely carrot-red hair—of the lowest class, evidently, for their one garment is a rough brown cloak dreadfully tattered and patched. Here, as mostly all over Albania, there is not much close veiling. It is boasted that, when on a festival the people gather in thousands in the large cypress-grove, no such assemblage of fine men and lovely women

can be seen elsewhere. As to the religion of the hill people, it seems doubtful if they are really Mohammedan. Most of them are Turks to the Turks and Christians to the Christians, nominally Mohammedan, while cherishing for centuries a sort of vague hybrid Christianity—perhaps a relic of the Albanenses. Such is the view of the scholarly old Bishop of Durazzo (Greek Church), who lives here.

We were a large caravan when we faced the stage between Elbassan and Ochrida—one of the worst for desolateness, steepness, and brigands. Having heard that a Frank was going, quite a number of travellers had waited to join us, for greater security. There was the old weather-beaten rugged *suvari* (Turkish guard), the *vetturino*, or horse-hirer, two Albanians bound for Asia Minor, a Greco-Jew bearing trinkets and stuff fabled to be worth £200, a quiet pensive young Turk, and several others. From the bed of the river Skumbi (anc. *Genusus*, town *Scampae*) we climbed by steep tortuous paths up a hill 1000 feet, then one 1700, then, by fearful sweeping bends around precipices, up to 2300 feet—and so on from height to hollow, from ridge to river, up and down for two and a half days, the last climb taking us up to 4000 feet, and showing us the glorious lake Ochrida, with a world of mountain all around. In the deep valley of the Skumbi the scenery is wild and rugged, and whatever cultivation is seen, is only on small plateaux at some height above the river-bed. On the north the mountains slope up and away in broad expanses of deep red varying to yellow-brown earth, then belts of trees, then bare round heights much scarred, resembling Herzegovina, and distinctly of Karst formation. We kept the south side. Sometimes for hours we would toil in the great heat—the thermometer never fell below 70°—under a huge wall of limestone towering 1000 to 1500 feet up, with torrents rushing and roaring down and carving out fearful chasms, around which we had to clamber with precarious footing, not reassured by skeletons of horses lying bleaching in the sun or pecked at by vultures below. Sometimes the eye would be dazzled by vast piles of red porphyry and glittering veins of quartz. Sometimes the whole side of a mountain would face you, black, a field of anthracite or other carbonaceous rock.

On a plain bit of road as we approached Khukuz khan (and village on the cliffs above it), we were in straggling order, when suddenly at a bend I caught sight of a group of men rising up as if surprised. The old *suvari* cried *chabook* (hurry up!). On came the big fellows, with skull-cap, jacket, and fustinella, and rifle slung at the back, and breast bristling with cartridges—one after the other, twelve of them, towards us. Our file and theirs met and were passing, when number three of them as he passed brought the barrel of his rifle right against my side. However, quietly and smilingly lifting it aside with my riding-switch, I declined the quarrel, and we all passed on in silence. "They 're all notorious villains and murderers," said the *suvari*, "but they 'll not venture this time, as they didn't expect the English effendi."

In the khan (where of course the twilight hour was spent in listening to Albanian singing, mainly recitative; theme, love and war), we all slept in one room on rush mats. New arrivals lay down amongst us until

MOUNTAINEERS OF ŠALA.

MIRDITI WOMEN FROM THE KROIA MOUNTAINS.

LAKE OCHRIDA AND THE MONASTERY OF ST. JOHN THE DIVINE.

JANINA, WITH ALI'S FORTRESS AND ISLAND IN THE BACKGROUND.

there was no more decent space. The cold was intense (at night). The fleas were in legions. The cocks began to crow two hours before dawn, and kept it up till dawn, so that the whole country from the riverside to the mountain crests seemed peopled with chanticleers—indicating that those deep side ravines and hollow nooks were not so innocent of inhabitants as appeared to the passing traveller.

Over the last ridge, we emerge at the north-west corner of the lake basin, and see what a vast country we are in—a ring of mountains, dominated on the north-west and north-east by several mighty peaks 6000 feet to 7000 feet (of Shkar, *anc.* Scardus); mighty gorges filled in with lower swelling hills sending down their alluvial debris to the shore; the deep-blue lake itself in the midst, with a broad belt of verdure for its margin. The many people we meet now on the fine road (*Via Egnatia*, re-made), are smaller, darker, less frank, speaking Bulgarian, wearing not the fez or fustinella, but the Bulgarian *kalpak* and cloak, or old soldiers' clothes. At Struga there seems to be a good deal of trade, especially in fish. The shore-line is broken with huge apparatus for fishing. Myriads of fowl blacken the water far out into the lake. All the way to Ochrida we met a continual stream of traffic—peasants, Albanians, and Greek *pappas* with their families, Turkish officials with retinues. At this great altitude (2100 feet, lake level), the flora is astonishing—vines, haricots, melons, pumpkins, gourds in the fields; wild vines, hollyhocks, valerians, spurreys, pearlworts, dianthus by the road.

Ochrida, built on two hills ending in cliffs at the lake, beneath the swelling bosoms of the upper mountains, on the margin of the beautiful blue lake, is one of the most charming places on earth. Here Christians and Mohammedans are about equal (population 12,000), and there is neither discontent nor oppression. Flowers abound in windows, gardens, yards, and walls, declaring (said a citizen) the presence of Christ. The swallows and cuckoos are here (they say) all the year round, and the storks build their nests on the tops of the minarets.

In the great vaulted gate of the old town (beneath the acropolis or *kastron*) are many lettered stones, mostly built into the ten-feet-thick walls. Some are pieces of entablature; others slabs. One is of a dark ruby colour, bearing Greek lettering in memory of some "Cleanthus, son of Ptolemy." Another (6 feet × 3 feet) bearing mixed Greek and Roman characters, the first word being AVPIΔ—which may be *Achrida* —is probably a milestone on the Via Egnatia. The bare massive walls alone remain of the early church of St. Clement (burnt by the Turks in the fifteenth century). In the one which replaced it (Byzantine) many relics lie about—pieces of columns and capitals inscribed—probably of the fifth and sixth centuries. In a side chapel there is a statue of Pope Clement of Rome sent by him along with a Madonna-and-child painting to his namesake St. Clement, Greek bishop of Ochrida. Around the exterior of St. Sophia (now a mosque), said to have been built by Justinian (sixth century), there is a Greek inscription which seems to refer to the teaching of the scriptures among the Mœsians (*τὸν θεόγραφον νόμον ἐκδιδάσκει ἔθνη τὰ* Μοισῶν).

Ochrida lake (anc. *Lychnitis*, possibly so called from its wonderful

transparency, which enables one to see the fishes disporting 20 yards below) is the largest of all Balkan waters, and is one of the most beautiful in Europe. Around it are some dozen happy villages in the alluvial hollows, besides Struga, Ochrida at the north end, and Pogradeč and S. Naoum monastery at the south end. The western side is in Albania, and consists of a succession of deeply wooded hills under a higher range, with cultivated alluvial slopes between. The eastern side is in Macedonia, and is almost precipitous to the shore (the Galičiča range, 6700 feet). The river Drin, issuing at the south-east end behind S. Naoum, flowing in its own course through the lake, and having its exit at Struga, is the boundary of these provinces. M. Reclus (who often has Jules Verne's so happy knack of truly describing what he has never seen) is quite "out" when he supposes that the lake had once its exit on the south by lake Malik and the river Devol; for the south end is a wall of mountain (from 500 to 1000 feet above the lake), and Malik is at least 150 feet higher in level. It is more than probable that the Drin, so copious a stream at its issue from the mountains, carries off subterraneously some of the waters of Lake Presba (to the east of Ochrida).

The only boats in use on Ochrida are remarkable, and perhaps of the oldest type extant—flat-bottomed, of some dozen pieces altogether, 18 to 20 feet long, narrow, bow rising like an ancient galley, broadening to the stern, a heavy log on each side outside along the body, four rowers on the port side (three in the bows and one at stern), and the steersman with oar at the starboard stern.

The sun sets over Albania, but Macedonia still seems all on fire. To us on the lake the water for half a mile from the beach is black with waterfowl fishing; the hills above Pogradeč are covered with dark woods, all good chestnut-trees; the yellow mountain slopes above are lined with long strings of goats wending their way home. The people about here are mainly Toskhs, and wear the fustinella; but as the local names (*e.g.* Pogradeč, from *pod* and *grad* = lower town) and the furred jackets and cloaks indicate, it is not long since the Bulgarian element predominated. They have an ill name, which the first news we got, that two passengers by the post (*menzil*) had just been killed, bore out. Their chieftain, however (Uzcheref Bey), assured me there was nothing to fear.

The great monastery of St. Naoum (*ἅγιος Ναούμ*) stands (opposite Pogradeč) on a jutting rocky strip of land close to the lake; is quadrangular, with white walls, red-tiled roofs, and with numerous outhouses, granaries, and workshops clustering about it. The rocks are limestone, much fissured, and out of them copious streams of clear icy water fall into the lake. The whole district around, including a village and the mountain, is tributary to the monastery. Besides the *ἡγούμενος* (superior), three monks and a schoolmaster, there are seventy inmates. There are cells for monks (formerly thirty), guest-rooms, a large veranda with mats for Mohammedans, stables, kitchen, slaughter-house, school, and a large residence for the superior and better-class guests. The church in the courtyard is a thousand years old, Byzantine, contains grey marble columns, many Cyrillic and Greek inscriptions, and the tomb of S. Naoum, who came hither from Asia Minor in A.D. 800.

From this to Koriča is an unvisited district. It is an undulating hill country as far as the end of Lake Malik, average height 3000 feet, with several considerable villages dotted over it—Čirāva, Čausli, Malikč, Sofiani, Kastifalik, in order going south. Malikč is at the outlet of the lake on the west, and it seems that is the name the river goes by too, being called Devol only much farther west. The plain with the lake in its midst runs on to the great Koriča plain, striking it at an angle of about 25°. At the north-east the Galičiča mountains drop abruptly on to a lower range which shuts out Lake Presba, while beyond and to the south rise the massive spurs of Pindus. The north end of the lake is filled up with gigantic reeds, leaving only a long line of water in the middle. The shores are choked with these, the nearest being 10 feet tall and those farther out 20 to 25 feet, with huge bulrush heads. Long lines of flame at points where they are being burned are visible even in the sun, 40 to 60 feet in the air. We pass plenty of good sandstone, fine hard slate, much trap-rock. The altitude of the plain is between 2400 and 2450 feet. The thermometer rose from 70° through the forenoon to 95° at noon. The flora consists of mighty water-lilies, spreading their cups among the rushes, tall red and yellow thistles (4 to 10 feet), enormous umbelliferæ, hyperaceæ, hollyhocks, valerians, blue and red geraniums, toad-flax, nipplewort, gallium, dianthus, poppies, sorrel, cress, phlox, rest-harrow. There is much cultivation—maize, pumpkins, melons, pepper.

Grandly placed is Koriča town under the Morava mountains on the east side of the plain, which are a long line of serrated, bare, reddish, or copper-coloured hills—trappean—average height 5500 feet. Koriča is very lively, a great market centre. All around it are fields, vineyards, vegetables, flowers, groves. The population is 19,000, of whom 12,000 are Greek Orthodox, and 200 or 300 Roman Catholic. They are dark in hair and complexion, and wear fez and fustinella. They call themselves mostly Greeks; but they are simply Albanians, largely mixed with Bulgarian blood. The true Albanian among them is always noticeable—by his head, broad at front, with knobs, and towering to the crown, flat behind, denoting intelligence with little reflection, firmness with much egotism. The mountain villagers about here are said to be very fanatical and treacherous. I climbed to the nearest village called Boria (*ἐμπόρια*?), where there is a Byzantine church of date 1390, the interior of which is covered with Cyrillic writing of date 1500. I climbed farther up to a peak 4300 feet, where are ruins called *čutet* (a word always applied to a hill town or castle; *cp.* city, citta, cité, civitas). They seem Byzantine—not Venetian or Roman as supposed—and are composed of the whinstone of the locality cemented with beautiful white lime. The Morava range is very rich also in granite and in coal, and possibly copper. Across the plain, among the hills, there is a good copper-field, and near a village called Debarza above Ochrida there is another; the specimens from both show excellent copper. Concessions to work have been granted to a local family of the name of Moscha, and French and German engineers will be on the spot this year.

From Koriča to Janina (pron. Yanina), four days' ride, is a wonderful

but terrible journey. The district has the worst name for robbers in all Albania. Roughly, it consists of a succession of ravines winding up and down among lofty mountains and tablelands. As far as a place called Elmizi (where are the sources of the Osum, farther west termed the Beratini, which presently joined to the Devol, becomes the Semeni, and falls into the Adriatic above Valona) there is no cultivation, only bare rocks (lime, whin, carbonaceous) sparsely clad with junipers—average altitude 4000 feet. Vast stretches of chrome slopes under the Grammos mountains on the east and the Skrapari on the west; many villages with minarets; a long, wide plain completely honeycombed with deep clayey gorges; a very Turkish, tumble-down, hoary-looking place called Hersek (3380 feet, temperature 69° evening), constitute the region called Colonia. Thence we pass into a very white limestone district containing some very deep fantastic ravines, with small Christian villages in them embowered in walnut groves and gardens. At the edge of one such you look down, from a height of 3500 feet, at least 1000 feet sheer below on a happy valley filled with flocks, village, mill, bridge, torrent, while all around rise pinnacled, castellated, or pyramidal heights of various hues, and towards the east two huge pyramids sending down their débris, all covered with woods and fields and nestling white houses. Here the tints of the soil often vary within a dozen yards—white, yellow, orange, violet, red, great masses of sulphurous stuff. The road proceeds by fearful zigzags from one valley to another. Then we descend into a blacker region—one of tremendous ranges—basaltic, trappean.

At the foot of one of those masses—one mile long and 2000 feet at least sheer up, a spur of the vast Nimerečka (7000 feet) towards the west—lies the town of Liaskovik, but at the head of a great heaving basin filled with miles on miles of lower hills, valleys, and rivers, stretching away south till blocked 80 miles away by the mountains of Thessaly. It would be hard to conceive a grander site. The town has a grey, decayed look, but is lively enough. Strangers seem to be feared, and it is said that there is a good deal of exaction on the part of officials. Beggars abound; one of them I saw sitting in manacles cursing and joking by turns. It is a real bit of Turkey: the very boys come up and demand your reason for going about; ladies close-veiled, and with parasol, are out taking an airing, and baby in cradle comes behind on the black slave's back; round the only fountain all day and evening there is a continual traffic and babel—dark Zingari servants and women, young and old, in scores crowd round the one slender source with barrels and pitchers, and the horses let loose after work canter up neighing and whinnying, and force their way to the spout.

Hence we descend into the bed of the Sarantaporos (forty fords) and the Vojusa, and clamber along precipices and then over a beautiful pass full of streams and woods to the plain whereon the two rivers meet—Vojusa and Charadra. To the north nestles the town of Koniča under cliffs and above green fields and the broad white expanse of river bed, while right overhead to the east are some of the giants of Pindus—Papingo, Lazari, Samarina, stupendous masses with one or two conical peaks. For half a day we wander up and down in the vast forest that

clothes all the mountain to the south, where the solitude is oppressive, unbroken except by the flutter of jays and the screeching of hoopoes. The trees are chestnut, walnut, oak, beech, locust, *Paliurus*, tamarisk. At about 2300 feet we begin again to descend, and come on to a plain (1300 feet, temperature 69° evening) covered with flocks and herds, skirted by oak woods, smelling sweet with clove and lavender, and surrounded by crenellated ridges, over one of which a road diverges towards Santa Quaranta. Here in the huge khan of Kalibakia we find a distinct approach towards Greek manners, and hence southward the same change in physiognomy, scenery, houses, cleanliness is noticeable. Up over several long hilly defiles for many hours, then down on to the plain at the end of which Janina lies, visible ten miles away. The plain at the north is 1½ miles broad, but widens a little towards Janina, and there is also a slight rise from 1600 feet to 1650 feet. This fact is important in considering the drainage of the lake. There is a great deal of water at the north end, miles of gigantic reeds (Lake Lapsista ?), and a long stone bridge (dilapidated) crossing it. Janina lies in the angle on the west, where the plain turns from north-west and south-east to north and south. The lake has two basins (of almost equal dimensions), one in either direction. Its water is (usually) dirty grey and strong-smelling, both colour and odour being due to insufficient outlet and much evaporation. The sinks (*καταβόθρα*) are the only outlets for all the water in the long depression of close on 25 miles, which is shut completely in by the Metzikeli range, running north-north-west by south-south-east, the ridge of Drysco, behind to the east, and the peak of Peristeri to the south.

On the rocky promontory jutting into the lake are the fortress and palace of Ali (Tepelini) Pasha, now barracks and hospital and common houses. On the summit beside a mosque and minaret, and beside the tomb of St. John (a Christian martyred by the Turks here, whence Joannina, John's town) Ali's headless body lies in a gilded tomb beneath a solitary cypress-tree. A few hundred yards across the water is the fatal island where Basilikē (his favourite) betrayed him, and his own soldiers shot him. The island is of limestone, contains several vast caverns (some always filled with water), inside one of which the old monastery and church of St. Panteleēmon are built. It was here in a room on the second story he met his end: beside the divan on the floor are five bullet holes. Only one old woman, a nun and rheumatic, is now in the place.

Janina is very fine, very Greek, there being three Christians for every Mussulman. The garrison numbers about 650 men, but 4000 *nizam* men could be brought in in a day or two's notice from the villages.

South-west over the hills lies the Pelasgic ruined city of Dodona, about nine hours' ride. You go over the plain to Rapsista village, then up a ridge 1750 feet; then another, 2100 feet; then (past vineyards!) up to 2650 feet; then down into a long valley running north-north-west by south-south-east past long fences of ancient stones, through meadows, maize fields, streams, bosky patches around cottages—walnuts,

limes, poplars (abeles), but mostly the ilex oak. This famous Thresprotian (or Molossian) valley is 2 miles broad by 15 to 20 miles long, average altitude 200 feet, each end being closed in with hills. On a jutting point of land (which is doubtless the promontory Hesiod mentions) are the ruins. The ilex-trees are everywhere around it, especially on the north; and here may have been the mysterious oracular wood, the rustling groves of Dodona, or it may have been across the valley and up the other side on the south around an abundant spring of water at *Alhochori*, where the trees (all ilex) are very big and old. There is no lack of falling water (another oracular means of Dodona), for the steep sides of Tomarochora (4500 feet) are scarred profoundly, and great torrent beds extend right out from it over to the temple site. The oldest building is behind the amphitheatre—rows and lanes of rough Cyclopean stones, mostly one yard square. The stones of the piers and amphitheatre (which faces due east) measure mostly $5 \times 3 \times 2$ feet, but at the top they are $8 \times 3 \times 2$ feet. The natives say that there are no treasures or trinkets to be found now since Karapanos carted away his "three wagon-loads" to Athens. See his *Dodone et ses ruines*.

From Janina a grand road (made by Ali Pasha) runs to Arta and Previza, through some of the scenes of the late war. Down, down, we go, skirting the dread Suliote hills—round precipice after precipice, under great hanging sloping masses, moraines, caverns, natural tunnels —over several most romantic passes with bluffs overhanging 800 to 1000 feet—down along the Louro (anc. *Oropus*) river in ever increasing richness and variety of scenery and indications of pleasant human life. We pass much traffic also on horses and in buffalo carts, for there is a vast opening for trade up this way. We notice a few burned and shattered cottages by the road. At nightfall the flaming hill-sides all around Philippiades (the brushwood being burned, but also something better, say the Greeks) remind one of the late reprisals and war horrors. The burned houses, villas, shops, and piazzas which to-day represent what once was a flourishing town tell the same tale.

The people are noticeably changing fast as we near the sea and Greece —slimmer, lither, sweeter in expression—but still the basis seem not Greek so much as Albanian (Toskh, Suliote).

Over a long plain, out now from the mountains, in sight of the Gulf of Arta and the Acarnanian mountains beyond—along sweet flowery hillsides covered with "asphodels beloved of the gods," to the grand vast ruins of Nicopolis (*Pallaio Kastro*), where in the desolation and silence one thinks of Actium, peerless Cleopatra, brave, foolish Antony, practical Octavianus, and then wondrous Ali Pasha—on through the old olive forests (a million trees) above Previza, into a sub-tropical fringe of palms, and aloes, and cactus, and orange-gardens at Previza, and then the sea, and Greece, and home.

EARLY EXPLORATION IN NORTH-WEST CANADA.

By Alexander Begg, C.C., Author of *The History of British Columbia.*

There is probably no portion of the Earth's surface which has attracted so much public attention as that which is popularly known as the "Klondike," by which is meant that portion of the Yukon region having for its centre the fabulously rich gold-bearing mines on the streams emptying into the Yukon river, near Dawson; one of those streams is the Klondike.

It may be of interest to the reader to learn a few particulars respecting that vast and rich mineral region, to know who was the first explorer to enter the country, and when it was first occupied by white men. This region is of immense extent, being estimated to be 1100 miles long from north to south, 800 miles in width from east to west, and to contain nearly 600,000 square miles, or about 370,000,000 acres.

To the celebrated Sir Alexander Mackenzie, one of the partners of the Montreal North-West Fur Company, who in 1789 travelled to the Arctic Ocean by the Mackenzie river, which will always bear his name, belongs the honour of having taken the first steps towards making known even the outlines of what was then a *terra incognita.*

In 1792-3, after a voyage to England, Mackenzie proceeded to the Pacific coast, following a south-westerly course from Lake Athabasca (lat. 59° N. and long 111° W.), *viâ* Peace river, and thence westward, in about lat. 54° N. to long. 133° W., to a stream, flowing south, which he mistook for a branch of the Columbia river. In 1808 Mr. Simon Fraser explored that river to its outlet on the coast, and it was named after him "Fraser river." Mackenzie, desirous of reaching the coast without going farther south, changed his course more to the west, and arrived at Pacific tide water July 22nd, 1793, at about lat. 52° N. and long. 129° W. Thus, in a totally unknown country, amongst savages, he had journeyed over seven degrees of latitude and eighteen degrees of longitude.

Until after the amalgamation of the North-West Fur Company with the Hudson Bay Company, in 1821, the vast region north of Lake Athabasca and west of Mackenzie river was unoccupied by white men. The North-West Fur Company had penetrated west, following Mackenzie's exploration, and south by the Columbia river to its outlet in the Pacific at Astoria. They had full possession of the whole country to the west of the Rocky mountains, which they named New Caledonia. The fur trade was extended enormously by them, but was chiefly carried on to the south of the Athabasca route.

After the amalgamation of the two companies in 1821, the business was carried on in the name of the Hudson Bay Company. They extended their trading-posts northward along Mackenzie river and westward to the Pacific. The officers sent in advance to explore, to build trading-posts or forts for defence, and to open up a trade with the natives, were men who had experience in the business, and were thoroughly reliable, being generally chosen to fill those important positions on account of their

capacity for management. They were required to keep a diary in which was entered every day the work performed by the men, amount of trade transacted, etc. etc.

The first record obtainable pertaining to the Yukon country is from 1834, when it was under the management of Mr. Robert Campbell, a native of Glenlyon, Scotland. He joined the Hudson Bay Company in 1832, and two years afterwards was placed in charge of the Mackenzie district with headquarters at Fort Simpson, which is situated at the confluence of the Liard river with the Mackenzie, in about lat. 52° and long. 122°.

Before the year 1838 Mr. Campbell had established several trading-posts on Liard river, and had reached Dease lake, the western head-waters of the Liard. He established a trading-post there, and with a few of his men crossed the "divide" or height of land between Dease lake and Stikine river, intending to proceed to the coast at Wrangel. On his way he was met by a large party of coast Indians and captured, but with his men escaped and retreated towards Dease lake. In their flight they destroyed an Indian bridge over the Tahltan to prevent pursuit. Shortly after the coast Indians joined the Dease Lake Indians, attacked the-trading post, pillaged it, and drove Mr. Campbell and his men out of their country.

Mr. Campbell then apparently shaped his course northwards along the Liard, for in 1840 we find trace of him at Lake Frances, the northern source of the Liard, where he established a trading-post. He next proceeded westward across the height of land to Lake Finlayson, which he discovered and named. In two days' further travel he reached a large river which he named Pelly. Returning to Fort Frances in 1843, Mr. Campbell again crossed the height of land to Pelly river, which he followed until he reached its confluence with another larger river flowing from the south, which he named Lewes. The junction of those two rivers forms the main branch of the Yukon river. Mr. Campbell was *the first white man* to stand on that spot.

He continued his explorations down the river for about seven hundred miles to the confluence of the Porcupine river with the Yukon. At this junction, about lat. 56° 50′ and long. 145°, Fort Yukon was established. Mr. G. Bell, of the Hudson Bay Company, in 1846 proved that establishment to be about 150 miles west of the 141st meridian, or the boundary line between British and Russian territory; but no Russians or any traces of their occupancy were seen. From Fort Yukon Mr. Campbell ascended Porcupine river to its eastern source, and crossed the height of land to Peel river, a small tributary of the Mackenzie, not far from its outlet in the Arctic Ocean. From the outlet of Peel river he ascended the Mackenzie to Fort Simpson, his headquarters, at the mouth of the Liard.

Again, in 1848, Mr. Campbell crossed to the Pelly, and descended that river to Fort Selkirk, which he named, and established a trading-post there. That fort was pillaged by the Chilcat Indians in 1851. After the pillage Mr. Campbell returned to Fort Frances.

During 1852-3 Mr. Campbell made a remarkable journey east. He

left White river, near the Alaskan boundary, on September 6th, ascended the Pelly to one of its sources, and crossed the mountains to a branch of the Liard, which he followed to Fort Simpson, arriving there October 21st. Winter having set in, he started on snow-shoes to make a journey to Crow Wing on the Mississippi river, extending over sixteen degrees of latitude. He had with him three men and a train of dogs. The dogs were changed at the Hudson Bay Company's trading-posts along the route.

The route from Fort Simpson lay by Great Slave Lake, Lake Athabasca, Ile à la Crosse, Carlton House, Fort Pelly, Fort Garry (Winnipeg), and Pembina. On March 13th Mr. Campbell reached Crow Wing, where he obtained horses for the journey to Chicago. From Chicago he continued his journey eastward, and arrived at Montreal on the 1st of April. Such was his despatch that he was enabled to report himself in London, at the Hudson Bay House, on the 18th of April 1853. From his starting-point on the Pelly-Yukon he had made a continuous journey of 9700 miles, nearly half of which was through an uninhabited wilderness; and of this distance some three thousand miles were passed over in the dead of winter on snow-shoes.

Eventually circumstances combined to produce changes in the trade of the Hudson Bay Company. The remote trading-posts along the Yukon and Porcupine and Fort Selkirk were abandoned. The Russian Fur Company did not build trading-establishments on the mainland. The Hudson Bay Company, however, in 1834 built a trading-post on Nass river, and being desirous of extending their trade along Stikine river, a vessel loaded with supplies was sent, in charge of factor Ogden, to the mouth of the river. On reaching the mouth it was intercepted by two armed Russian vessels which fired upon it.

Retreating beyond range of the shot, the crew cast anchor. Soon a boat from the shore approached and intimated that if they desired to save themselves, their property, and their vessel, they must weigh anchor at once and return to their own harbour. With this notification they complied, and returned to Fort Vancouver, near the mouth of Columbia river. A report of the affair was transmitted to London, along with a claim of £20,000 sterling as damages for interference and the loss of trade in consequence of the posts up the country not receiving their supplies.

After considerable delay the claim was waived, and the dispute settled by the Russians agreeing to grant to the Hudson Bay Company a lease of all their territory lying between Cape Spencer (lat. 58° 15′ N., long. 136° 30′ W.) and Cape Chacon (lat. 54° 40′ N.), on condition that the Hudson Bay Company paid an annual rental of two thousand land-otter skins, and at the same time supplied the Russian colony at Sitka with a large quantity of provisions at moderate rates. This lease gave the Hudson Bay Company full control of the fur trade with the natives, and power to prevent United States traders from trespassing in the various channels and inlets to which they had access from the ocean.

The arrangement gave satisfaction to both parties. The irritation

caused by the unsettled line of demarcation disappeared. Wrangel and Stikine river and all the islands south of Cross Sound (Cape Spencer) were added to the former immense hunting-grounds of the Hudson Bay Company. It is interesting to note how exact and perfect was the management of the Company, and how uniformly their trading-posts were extended to more remote places, viz., to Nass in 1834, under Mr. Ogden's management, and to Fort Frances, Fort Liard, and Dease Lake, under the supervision of Mr. R. Campbell.

In 1840, Fort Durham was built at Taku, but was shortly afterwards abandoned, as it was decided that it would be more profitable to trade with the natives from the decks of the Company's vessels than to maintain permanent trading-posts. In 1843, when Fort Victoria was completed, all the Pacific coast forts were closed, with the exception of Fort Simpson, near Nass river. (This Fort Simpson should not be mistaken for that of the same name on Mackenzie river.) Fort Durham on Taku Inlet was the most northern trading-post built on the Pacific coast.

Whilst the changes referred to were taking place, the remote, outlying Yukon region was, in a measure, lost sight of. The exclusive privileges of the Hudson Bay Company over that portion of the continent of North America, west of the Rocky mountains, had been extended for twenty years. Their lease from the Russians had been renewed; general prosperity prevailed. Changes, however, were at hand. New Caledonia and Vancouver Island were formed into a Crown colony. Its northern boundary was fixed at the 60th degree of north latitude. Its western boundary was not defined otherwise than by the Anglo-Russian Treaty of 1825—nor was it necessary under the Russian lease.

The lease, however, terminated in 1867, when the United States Government purchased "Russian America," together with all its rights and privileges. The gold excitement of 1858, in British Columbia, created many changes. The result was that a large number of the floating mining population remained in the country, and engaged in developing it, so that little attention was paid to the northern country, with the exception of the Stikine river and Dease lake region, in connection with a temporary gold rush.

From San Francisco, *viâ* St. Michael's and along the Yukon to Fort Cudahy, considerable trade was carried on; but until after Dr. G. M. Dawson's visit to the Yukon region, in connection with the Canadian Geological Survey, in 1887-8, no reliable maps of that country were published. Dr. Dawson entered the country by the Stikine river and Dease lake—thence by Liard river, following Mr. R. Campbell's route, already referred to. From Fort Selkirk, Dr. Dawson travelled by the Yukon, to the point on that river named "Dawson" after himself. He returned south by Lewes river and portages to Lynn Canal. Along with his report, Dr. Dawson published a map in three sections, giving details and particulars of his circular trip to the country which has since become so famous.

It would appear from a reference made to "Dawson" by a lady, who

has wintered there (1898-9) that the climate for a portion of the year at least is very enjoyable. The lady writes (April 8): "The March month of the Yukon is one of the gems of the year. Of all that dwell in my memory, this March, spent in the Yukon, has been incomparably the finest; from first to last a series of still, fair, sunshiny days, each lengthening and warming into greater geniality, until now in these last hours the little hill-encircled basin and its bit of the big Yukon river is flooded with sunshine; the surface of the ground is soft enough to demand the pulling off of moccasins and felt boots, and the daylight lasts far into the evening.

"Scanning the past weeks, we recall nothing of the raw wind, or rude or blustering blizzard—only a gentle, continuous mellowing from mid-winter severity, and a gradual, gracious extension of warmth and light.

"It seems absurd to have to come to the sub-arctics to deify March, yet here in this windless valley of the Yukon it has been a glorious month throughout."

Since the present gold excitement has taken place in the Yukon district, there has been considerable irritation manifested by United States citizens relative to the boundary line between Alaska (formerly "Russian-America") and British territory. The latter includes the North-West Territories of Canada and the province of British Columbia, which are separated from each other by the 60th parallel of latitude. Here again there has occurred some friction, as a new gold-field, Atlin, was discovered last summer, partly on the boundary line just mentioned. Miners having claims on the north side of this line are subject to the North-West Territories' mining regulations, whilst those on the south side must comply with the British Columbia mining regulations, which are in some respects different from those of the North-West Territories.

Again, as if to complicate matters still more, an alien Act was passed last session by the Parliament of British Columbia, restricting citizens of the United States, and other aliens, from taking up mining claims in British Columbia, and thus placing them on the same footing as Canadian miners in the United States. Many of those aliens have left Atlin. Some of them have crossed the boundary line (141st meridian) to Alaska proper; others have gone towards Dawson. The line of demarcation between British Columbia and the North-West Territories is now being surveyed and marked out. There is pressing need for the permanent location of the boundary line between Alaska and Canada from the Arctic Ocean southwards to Cape Chacon.

There is no difficulty in locating the line of demarcation from the Arctic Ocean south to the Pacific Ocean on the 141st meridian, according to the Anglo-Russian Treaty of 1825. That meridian passes a few miles to the west of Mount St. Elias, and the boundary should only reach to within ten marine leagues of the ocean coast, at the Gulf of Alaska, and then proceed, according to the Treaty, ten marine leagues distant therefrom, until it reach Cross Sound or Cape Spencer, leaving the "strip of land" mentioned in the Treaty as belonging to the United States.

Then starting from the point where the strip of land on the mainland ends, the line is continued parallel to the ocean coast and follows its windings south-eastwards down to lat. 56° N., not at any part of it receding more than ten marine leagues from the ocean; the outer or landward side of this strip of land (or land and water) is to follow the summit of the mountains situated parallel to the coast, where such summit shall prove to be at a distance of not more than ten marine leagues from the ocean.

As a portion of Prince of Wales Island lies north of the 56th parallel of latitude, and as the whole of that island is assigned to Russia, the Treaty accordingly directs that the line of demarcation shall commence from the southernmost extremity of the island (Cape Chacon), and shall ascend north along the channel which bounds the island itself, and which is shown on the map as "Clarence Strait" (otherwise called Portland Channel), to the point of the continent where it strikes the 56th parallel (*i.e.* at the 132nd meridian). From that point the boundary as above described proceeds in a north-westerly direction to the mainland at Cross Sound, thence to the 141st meridian and on that meridian to the Arctic or frozen ocean.

It may probably suit the High Joint Commission to agree to the foregoing interpretation of the Treaty, which is believed by hundreds of Canadians to be correct; or they may modify it somewhat, by making a conventional water-boundary from Cross Sound throughout, running to the east of Chichagof, Baranof, and Kuiu islands to the northern end of Prince of Wales Island, thence to Clarence Strait and Ernest Sound, where the 56th parallel of latitude strikes the continent. Such a line of demarcation would be suitable and convenient both to Great Britain and the United States, and would restore to British Columbia her original frontier, which has been sadly encroached on since 1867.

THE TRANSCASPIAN DESERT.

At the time of the International Geological Congress held at St. Petersburg in 1897, Professor Georg Boehm [1] and Professor J. Walther joined the Ural excursion and visited Transcaspia. Crossing the Caucasus and the Caspian Sea, they arrived at Krasnovodsk, now the terminus of the railway. The town stands 70 feet below the level of the ocean, at the foot of steep bare walls of rock, which leave a small strip free along the shore. Krasnovodsk is rapidly rising in importance. It has hardly a drop of fresh water, and all the water for drinking purposes is brought by the railway from Jebel, or distilled from sea-water. Vegetation, too, is entirely absent, and the heat and dust in summer are almost unbearable. Nevertheless, the traffic of the port increases rapidly from year to year.

A rather steep path leads to the heights above, where a Persian

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[1] *Geographische Zeitschrift*, Heft 5.

works several quarries in the limestone which covers the plateau with horizontal strata. It contains numerous fossils, which prove it to be of late Tertiary date. North-eastwards the flat steppe stretches out as far as the eye can reach, chiefly covered with stems of *Zygophyllum*. Neither man, nor quadruped, nor the cry of a bird, breaks the almost oppressive silence. Beetles swarm on the ground, and many holes and sand hillocks of rodents—*Meriones* and *Spermophilus*—make caution necessary to the rider. From the edge of the plateau the view extends over the town of Krasnovodsk and the Caspian Sea, and inland the characteristic weathering of the desert is distinctly perceptible. A curious rock, in form like a glacier table, was examined. The base, being more shaded, had weathered more quickly than the upper part, and the sand driven by the wind had gradually hollowed it out so as to produce the typical mushroom form. In some places the cliff was carved out so as to leave pillars projecting from its face with room enough behind for a man's arm to pass through. The exfoliation produced by salt was also observed. The crystallisation of the salt in the crevices of the rock produces a scaling which must be considerable in the course of time.

On the strand at Krasnovodsk are dykes of an eruptive stone, apparently a quartz-porphyry. It was impossible to obtain a fair specimen, as the rock split into small fragments. This also is a desert phenomenon due to the great changes of temperature.

The interesting element in the population of this region are certainly the Turkomans. Many are of splendid physique; their looks are keen and bold, and their bearing proud. The dark, long *khalat* suits their graceful figures, and the tall, shaggy sheepskin *kalpak* gives them a wild, formidable appearance. Brave and cruel, this adventurous people were the terror of Khorassan and Mazanderan, but now they are as good subjects of the Tsar as they were formerly his bitter enemies. The Turkoman murders, but his word may be trusted implicitly.

From the station Jebel, Professor Boehm and his companion rode on camels to the Great Balkan. Jebel itself lies in a sandy desert, but at no great distance gravel is seen, which has been brought down from the mountains by the rain torrents. On the western slope of the mountains are great screes of débris.

From Jebel, Molla-Kary (Black Priest) was also visited, the travellers making use of one of the trains which carry water to the desert stations in huge vats, said to contain 2200 gallons each. At Molla-Kary are small salt lakes where Persian labourers, under a Russian foreman, extract the salt. Near the water the vegetation becomes more luxuriant. Besides *saxaul* (*Haloxylon ammodendron*) and strong stalks of *Aristida pungens*, one of the most important grasses as fodder for camels, there were in September tamarisks far higher than a man, with beautiful red blossoms. The footprints of various animals were seen on the sand, but no life was visible except in the water, which was in some places coloured red by the well-known crustacea *Artemia salina*. Small shells of *Cardium edule* were also collected, but no living example.

Ten miles west of Molla-Kary is Mikhailovskoie, at one time the

terminus of the railway. Owing to the difficulty of landing, and the sanding-up caused by the east wind, the railway had to be carried 17 miles farther westwards, to Uzun-ada, where, General Annenkof believed, the sand could be held in check. But he was mistaken; Mikhailovsk and Uzun-ada are buried, and the sand is still advancing westwards. The presence of *Cardium edule*, still bright in colour, and the excretion of pure gypsum show that the salt lakes of Molla-Kary also were not long ago connected with the Caspian. Indeed the whole Darja peninsula is probably a recent creation, and the tongue-shaped Balkhan gulf running inward towards the east would be filled up were it not protected by the mountains from the north and east winds.

The subject is of importance in connection with the much-discussed Oxus problem. At Molla-Kary and Uzun-ada borings have been executed, and no river sediment found. Nor is anything of the kind seen at Jebel, and thence up to the Great Balkhan. Hence it may be inferred that no river has flowed past these points to the Caspian Sea in recent times. It is, however, too much to conclude that the Amu Daria, or some other river, has never flowed into the Caspian north of the Little Balkhan, for if the Oxus at one time filled the dry bed of the Uzboi, it did not necessarily flow past Jebel, as the coast of the Caspian then lay farther eastwards. Consequently Russian topographers have been able to trace the Uzboi only up to the Little Balkhan north of the station Pereval.

Pereval is a typical desert station. It consists of a large one-storied building, a block-hut for a policeman, a shed for railway material, and one for the Persian labourers who keep the rails clear of sand. All around there is nothing but sand up to the horizon. Every morning a train brings water from Kazanjik. Not far distant, towards the south, lies the Little Balkhan. As on the approach to the Great Balkhan, here also is a plain with sand, and then a waste covered with pebbles. Here and there lie *takyry*, grey patches of salt clay or loam, flat as a threshing-floor, and entirely bare of vegetation. On the plain were found numerous Cretaceous fossils, polished, like the pebbles, by the sand, and glittering in the sun. For the first time on the journey wild animals were seen—a fox (*Melanotus Pallas*) and an antelope (*Antilope subgutturosa*). Table mountains were not seen, nor is this strange, for they are connected with horizontal or but slightly tilted strata, and here the strata dip 35° north-north-west. The rain torrents, though rare, can develop their full erosive power in the bare mountains, and have excavated numerous isoclinal ravines in the dark sandy, yellow, and grey limestones. The fossils lie in great masses, the wind having borne away the lighter products of weathering.

Still travelling eastwards, the professors came to Kizil-Arvat (Red Maiden) in the Akhal-Tekke oasis. Water is conducted for several miles from the Kopet-dagh to the station, where it shoots up in the middle of a large basin surrounded by trees, the first the travellers had seen after leaving Baku. Here there are no palms as in the African oases, but the trees are of more familiar species, chiefly poplars and willows.

Askhabad (Abode of Love), now the capital of the Transcaspian

territory, was till 1881 a Turkoman *aul* with about 500 *kibitkas;* in 1892 it contained more than 12,000 inhabitants. The Persian frontier is only some 22 miles off, and the Transcaspian railway has attracted a large part of the north Persian trade. In 1893 the exports were worth £610,200, and the imports £449,280.

Here, and also near Bokhara, are seen various forms of artificial tumuli, called *kurgany.* The larger heaps were intended to raise buildings of importance above the surrounding level country, while others of much smaller dimensions served the purpose of watch-towers or for protection. But the greater number of the kurgany cannot have been thus used. They stand often in great numbers side by side, and their size and form excludes the possibility that dwellings were erected on them, while they would hinder rather than facilitate observation of the neighbouring country. Very probably they are nothing but mounds which a prehistoric people threw up over the graves of dead, or as cenotaphs in their honour.

The desert first appears in all its terribleness about 600 miles from Krasnovodsk, beyond Merv, near Repetek, and beyond the Amu Daria between Farab and Khoja Davlet. High dunes skirt the railway on either side, generally without vegetation. Poles have been set up to measure the advance of the sand, and ditches have been digged and fences of saxaul planted to protect the line. Here and there an attempt has been made to bind together the sand of the dunes by planting saxaul and *Salsola arbuscula.* The frightful sea of sand spreads in huge undulations to the horizon, and occasionally appears an elegant crescent dune (*barkhan*), with its gentle convex slope towards the wind, and its steep concave slope to leeward. The vegetation passes through all stages, from the blossoming tamarisk of Molla-Kary through the dune grasses to the complete bareness of Repetek. Arboreal vegetation and compact turf nowhere occur. At the best the bushes are scattered, and even the grass grows only in tufts, so that the bare soil is visible at all seasons of the year.

It is usually supposed that a desert is monotonous, and so it is as regards its fauna and flora, but the surface forms are manifold; mountains with their gorges and screes, flat sandy stretches, dunes and crescent dunes, takyry and salt lakes. Dust-fog was seen by Professor Boehm, on October 8th, west of Bokhara. It was nearly calm, and the saxaul bushes by the line scarcely moved, but a stream of air rose from the heated ground and carried the dust up with it.

The history of deserts is by no means the same. The Sahara, contrary to the opinion once universally held, has been dry ground for a long period ; late Tertiary or diluvial deposits have never been discovered in the interior. The case is quite different with the Transcaspian desert. In the first half of the Post-Tertiary period the Caspian Sea and the Sea of Aral were far more extensive than they are now, and joined one another to the south of the Ust-Urt plateau. At many places in the Transcaspian desert marine fossils give evidence of this diluvial Aralo-Caspian period. Afterwards the great inland seas shrank up into the two main basins now existing, and this drying up seems to be still con-

tinued. Many travellers speak of the constant diminution of the Sea of Aral, and, according to Von Schwarz, about four times as much water evaporates in Turkestan as falls in the form of rain and snow. Formerly the precipitation must have been much greater, and at first one is inclined to connect the change with the melting away of the inland ice of the diluvial period, and to suppose that with the ice mantle the "pluviatile" period also came to an end. But the same view has been entertained in the case of the Sahara, and there, at least, it has not been confirmed.

Radde complains (*Petermanns Mitt., Erg.-Heft.* No. 126) of sleeplessness caused by the flies and fearful heat by day, and by mosquitoes and midges at night, and at Repetek Capus registered 115° F. in the shade. Thermometers graduated up to 140° only cannot mark the maximum temperature in the sun. At the end of September and the beginning of October the heat was quite bearable, and flies and mosquitoes were not seen.

The Russians are doing excellent work in Central Asia. Where once the Turkomans committed atrocities, the very description of which makes the blood curdle, an unarmed traveller can pass in safety through all the land. A few decades ago Bokhara was a hot-bed of the most savage Mohammedan fanaticism, whereas now there is perfect security among the motley crowd of Tajiks, Sarts, Persians, Uzbeks, Turkomans, Khirghiz, Afghans, Hindus, and Jews. Nay, a stranger seems to be a welcome sight. The Russians have freed the people from a most oppressive tyranny, and showered down on them the blessings of civilisation. They have given them security for life and property, petroleum to light their houses, and with the railway opportunity for earning money, trade, and traffic.

The revolution caused in commercial affairs by the Transcaspian railway is astonishing. Before its construction the whole annual export of cotton from Central Asia to European Russia was only 9680 tons, and the cotton was then carried on camels through Orenburg. The railway transported to Russia 96,723 tons in 1897. Built, in the first instance for purely strategical purposes, it is of ever increasing importance in the trade of Turkestan, Bokhara, Northern Persia, and Northern Afghanistan. Quite recently a stone railway bridge has been thrown across the Syr Daria, and communication established with Tashkent (156,500 inhabitants), the fruitful Ferghana district, Marghilan (40,000 inhabitants), and Andijan (34,000 in 1891). Surveys are also in progress for the extension of the line from Tashkent to Chimkent (10,000), and Vernoie (23,000). Furthermore, in spite of heat and sand, and the absence of wood and stone, a branch has been carried 200 miles south of Merv to the frontier of Afghanistan, which must draw to itself a great part of the trade of that country.

The object of the Russians, according to Professor Boehm, is to open a way for their trade to India, preferably by peaceful means, but by force of arms if necessary. They possess an excellent base of attack at Kushka, the end of the Murghab branch railway, barely 90 miles from Herat. On the other side the Indian railways have been pushed forward to the Afghan frontier at Peshawar and Chaman. The distance between

Kushka and Chaman is a little over 370 miles in a straight line. There are no great engineering difficulties along the route. The railway from Moscow now runs through Rostof to Petrovsk on the western shore of the Caspian, so that on the completion of a line across Afghanistan, railway communication between India and Europe would be interrupted only by the Caspian Sea, and India might be reached from Berlin in about ten days. Professor Boehm expects that the railway would let in the stream of European civilisation into Afghanistan. As to communication with India, his estimate of the duration of the journey does not promise much, seeing that Bombay can now be reached from London in a fortnight.

THE WESTERN ERG OF ALGERIA.

A COLUMN under the command of Colonel Lugan marched a few months ago from Biskra through Tougourt to Ouargla, the object being, according to the newspapers, to test the practicability of conducting a detachment of soldiers over the sands, and to show the natives that an insurrection could be suppressed even in the extreme south of Algeria. As this statement seems to show that the old notion that the whole Sahara is covered with sand still survives, M. G. B. M. Flamand has described, in the *Annales de Géographie*, May 15th, the really sandy regions of the Sahara, dwelling chiefly on the Western Erg, which he has himself twice crossed.

The route from Biskra to Ouargla is the best to choose in order to avoid the sands, which nowhere occur in the form of true dunes. The true sandy desert lies to the east and west, while Ouargla and El Golea are situated between the regions of dunes, the latter marking the limit of the Western Erg.

The Eastern Erg has been the object of long research, and has been traversed in all directions by numerous travellers—Duveyrier, Mircher and Vatonne, Largeau, and the expeditions of Flatters and Foureau—and, thanks to the latter especially, its topography, orography, and resources are well known.

The Western Erg does not extend farther east than El Golea, where its last undulations abut on a lofty Cretaceous escarpment. Westwards it stretches to the right bank of the Wed Saura (Messaura).

The Sahara of Oran, or Haut Sahara, consists of six natural zones succeeding one another in regular order from the Atlas chain (mountains of Figuig and of the Ksours, Jebel Amur) to the massive highlands of the Tuareg in the Central Sahara. These are (1) the stony plateaus (*hammada*) cut up by large drainage channels; (2) the zone of the great weds; (3) the Erg or great dunes; (4) the peneplain of Meguiden; (5) the *Shebka* (country furrowed with ravines) or *Baten* (slopes) of Tademait; and, beyond, the depression of Tidikelt (6). M. Flamand's paper deals with the third of these zones.

In the Haut Sahara the Erg immediately adjoins the zone of expansion of the great weds, the southern part of which constitutes the *ujh*

(cheek) or border. Its feeble development, and more than all the presence of numerous *gour* (precipitous rocks) and stony plateaus deeply eroded, have not allowed this region to assume all the characteristics that it exhibits in the south east of Algeria, or to present them in the same degree. It stretches southwards to the long depression of the Meguiden, runs into the oases of Tin Erkuk (northern Gurara), and in the south-west attains the rich valley of the Saura. Its northern boundary runs obliquely to the meridian in a winding line passing a few miles south of Hassi-Bu-Zeïd (Wed Segguer) towards Um-es-Sif (south of Wed Gharbi); it then rises a little to the north as far as Sidi Brahim, which is considered the entrance of the Areg. Beyond this point, that is towards Wed Saura, the Erg is still imperfectly known, and its limits cannot be exactly defined. The length of the Erg in its northern part, from the Ksor of Igli on the west to Hassi-Bu-Zid on the east, does not exceed 370 miles, while its breadth along the oblique line of march from the second Mekam Sidi-el-Haj Bu-Hass to Ras-er-Reg is about 56 miles.

This immense sandy region is irregularly divided into zones of elevation and hollows, while on the north are plateaus and the plains called by the native inhabitants *tr' atir* (sing. *tar' tar'*). The compact chains of great dunes rarely exceed 200 to 260 feet in height. While their main direction is east-north-east to west-south-west, they also form secondary chains, which cross one another and sometimes block up the valleys in the sand. Between the great chains are extensive hollows, often entirely covered with sand, *fej* or *wed*, in the lowest parts of which grasses, herbs, and shrubs grow in profusion (*Arthraterum pungens*, *Retama retam*, *Calligonum comosum*). Contrary to the prevailing notion, the sandy region is not the true barren desert; more frequently it is a welcome stage for caravans.

The wells of the Erg are unfortunately few and far apart. In depth they vary, becoming shallower towards the south—100 feet at Hassi-el-Azz, 46 feet at Hassi Aisha, and at the edge of the desert near the Meguiden only a few feet. The water is excellent and abundant, which is far from being the case in the south-west as reported by the Foureau expeditions. The wells, digged by the people of Gurara, who are very expert at this work, are lined with wood or masonry. Some of them have of late been allowed to fall into decay, or have been wilfully damaged by the natives, prompted by ill-will towards the French, but they could be easily restored.

The track worn by the feet of numerous travellers, horses, and camels winds in and out among the accumulations of sand, and is also fairly distinctly marked by refuse of all kinds discarded by the caravans, and grass and bushes cropped by the animals. Atmospheric erosion, though very active, hardly ever effaces these traces, and after a few weeks spent in the Erg the traveller has no difficulty in detecting them. He soon learns also to recognise the inequalities of the ground which appear at first so confused, and little by little fixes in his mind their individual characteristics.

Recent data collected by explorers show that the maps of all this country need considerable alterations. General de Colomb and M. de la

Ferronays on the map of their route have marked the northern boundary of the Erg near Raknet-el-Halib and Zebeirat, and the fringe is shown as extending to the north of the Daïa Um-ed-Dhar, and Colonieu on his journey to Gurara and Auguerut recognised the commencement of the dunes at Teniet-el-Merkh, a point far to the south of the Meharreg; but the map annexed to his narrative shows the same error as regards the limit between the Wed Gharbi and the lower Wed Segguer. All authors and geographers have assumed that the Erg commences where the weds disappear, in which case it would have a breadth, from north to south, of fully 125 miles. If in addition it be supposed to be perfectly arid and contain mountains of sand 1000 to 1300 feet high, it may well seem impassable to any but a native.

The chief mining-engineer Jacob (1892-93) was the first to furnish valuable notes on the limits of the Erg; he gave the southern extremity of Sahan Muïna as its commencement—the Fum-el-Areg of the natives. "The route," he says, "we followed on our return from Hassi Ushen follows from Daïa Um-Jedran the edge of the Erg, if this term be used in a somewhat loose sense. It is not the unmistakable Erg, such as is seen at Hassi Ushen; at Hassi Aïsha it is a tract where sand does not entirely cover the ground, where after crossing a few miles of sand dunes one comes again upon hammada or hollows in which the bottom is impregnated with gypsum and bare of sand." This description corresponds to that of the zone of weds or the *ujh* of the Erg.

On another route, that of the Ulad Sidi Sheik, M. de Lamothe, who accompanied Commandant Godron to Gurara in 1895, remarked the change in the character of the ground at the hollow of the Mekram Sidi-el-Haj Bu-Hass. His observations reduced the Erg to the interval between Sidi-el-Haj Bu-Hass and the *reg* of Tabelkoza, a distance of about sixty miles. M. Flamand in 1896 followed the route of the Ulad Sidi Sheik by the Wed Gharbi, and connecting Tabelkoza to Fort Mac-Mahon, to the Meguiden and Tademait, and observing the geographical positions of the chief points on the route, fixed the boundary of the Erg at the sandy bar of Um-es-Sif a little to the south of the second Mekam Sidi-el-Haj Bu-Hass.

The sand of the dunes is very different from that of the *nebak* or dunes in the beds of the weds. It is more compact and gives better foothold, and therefore is less troublesome to travel over than the isolated groups of dunes in the zone of weds, such as those of Laghouat or Selselet-el-Melah, where the sand gives way under the feet of men and animals.

By this route, used by the Ulad Sidi Sheikh, and which to the north reaches El Abiodh Sidi Sheikh by the Wed Gharbi, the extent of true Erg to be traversed is about fifty miles. The track is almost all sandy except here and there on the bottom of a *daïa* or *sebka*, and the last five miles of the last stage from Hassi-er-Reg to Tabelkoza. For most of the way the dunes, in groups or isolated, are of no great height, and the most arduous stretches can be passed without much exertion. These are the Teniet Hajela between Hofrat-el-Ga and the Wed Abd-el-Kherim. The ascent of the col immediately to the south of Hassi-el-Azz, 200 feet

above the well, which demands twenty minutes on camel or horse and half an hour on foot; and the passage over the chain of dunes separating the Wed Gueblia from the Wed el Khadem. The small tract of sandy plateaus towards the Wed Rekama and the Wed-er-Retem is also somewhat troublesome to travellers.

On the homeward journey M. Flamand's expedition made the passage of the Erg by a route different a little from the preceding, and from the notes of the journey it may be calculated that the distance, following all the windings of the route, was 55 miles. The average rate of march varied from 5 to 1½ miles per hour; but, supposing that a traveller was on foot and marched only 2 miles an hour for six hours, he would cover 12 miles in the day, and would cross the Erg in five days.

On the route from Hassi Ushen to Tabelkoza the dune region is also very restricted. Hassi Ushen is 24 miles from the Fum-el-Areg, and Tabelkoza is only some 30 miles from the former point, so that the total distance is not more than 55 miles, and even from this some 7 miles should be deducted for the gardens of Tabelkoza, extending to the southern boundary of the Erg. In general, then, a breadth may be conceded of 60 miles in a direction somewhat inclined to the meridian; towards the north-east it becomes greater. The height of the dunes appears in no case to exceed 300 feet, measured from the hard bottom of the hollows; according to the engineer Jacob it is still less—only 130 in the western part. Pasturage is by no means wanting, but on the contrary is excellent and of various kinds.

The caravans which annually make the journey from Algeria to the oases of Gurara and Tuat assemble in the oases of Sud Oranais—Brézina, El Abiodh Sidi Sheikh, Mograr Tahtani. The number of men and baggage camels in a caravan depends on the trade, becoming very large if the date-harvest is good in the gardens of the Tuat oases, or if pastoral products, animals, wool, and fleeces are abundant in the north. The average number of men in a caravan is 1000 to 1500, and that of baggage camels 2000 to 3000, but varies considerably. MM. Lacroix and De la Martinière speak of caravans consisting of 2000 men and 6000 to 7000 camels. Women and children (sometimes to the number of 500) join the party, for such a journey is a continual fête, and the crossing of the Erg, which appears so terrible to us, is a real pleasure to this people. A successful chase among the dunes yields the material for a good feast, and the pleasure of the day is prolonged into the night.

The men collect in groups from the same tribe; mounted men precede, follow, or ride beside the column as it slowly marches along the winding path, but the greater number, men, women and children, go on foot, chatting and playing on the way. The camel-leaders, guides, and riders also usually walk to spare their animals. Most of them make the greater part of the journey on foot, whether they be Arabs, Harratin, or Negros, and, moreover, barefooted. A few, however, protect their feet from the burning sand by a simple sole of antelope skin, while those who can afford it wear the Moroccan slipper of yellow leather. But the best footgear for the desert is the buskin of Gurara, made of camel's hair with a broad, thick, rectangular sole. It is pliant and light, and is very much worn in Gurara.

All the routes from Algeria to Gurara and Tuat are easily traversed, and before long precise details will be obtained about them. The regulation of the wells is the chief necessity, and then the route will be more frequented than at present. In crossing the desert the stages should be restricted to about 12 miles, and never exceed 15; six hours should be the longest time spent on the march in one day or night. The riding animals may be horses or riding camels. The former are more manageable and soon become used to the ground, but the necessity of carrying barley for them limits the number that can conveniently be taken. M. Flamand's horses returned to Géryville in good condition after travelling 870 miles in the course of two months, and twice crossing the Erg. The journey can be comfortably made from October to the end of May, the heat being at this season not excessive; the maximum varies from 82° to 97° F. between noon and 3 P.M. in April and May, and is lower in the other months.

All the baggage animals should be camels, for in the Erg they find their favourite fodder and nothing need be carried for them. They browse by the way, and at night feed on the pasture always found near the wells, and drink only once in three or five days at most.

ZONES OF CULTIVATION.

THE distribution of the flora of the world in general has often been the subject of cartographical representation, and the climatic limits of cultivated plants have been defined, but, as far as we are aware, the representation of the exact quantity of each kind of vegetable product in each small area has not been attempted until now, when Herr Engelbrecht has, with great labour and care, collected statistics of agricultural products and domestic animals from all countries of the temperate zones where such have been kept.[1] His results are published in three volumes, of which the first contains an introduction treating of the material and its utilisation, and a detailed account of the distributions of the various crops and their peculiarities; the second consists of tables of agricultural returns; and the third is an atlas in which the work of the author finds its ultimate expression.

As during this century almost all the lands of the Temperate Zone have been at least sporadically settled by farmers and graziers, the author regards the present time as suitable for a review of the subject. We must, however, expect great changes in a not far distant future. As population increases, new countries will produce larger quantities of agricultural produce, and grazing will be more and more restricted to lands which, from their soil, or situation with regard to means of transport, are less suitable for cultivation.

Agrarian statistics are compiled in most civilised countries, and the

[1] *Die Landbauzonen der aussertropischen Länder.* Von Th. H. Engelbrecht. Berlin, Reimer, 1899.

mass of material Herr Engelbrecht has had to deal with must have been enormous. The difficulty was still further increased by the variations in the system of compiling the statistics. In Spain, for instance, all grains are grouped together, no distinction being made between lands planted with wheat, barley, rye, etc., and consequently Spain has to be left blank on most of the maps; and similar difficulties, though of less importance, occur in the returns of some other countries.

Having reduced his statistics to order, the next question the author had to consider was the choice of a suitable standard to which the areas under each crop should be referred. He wisely rejects the number of the population, as the relation of agricultural produce to this unit would yield no indications of the state of cultivation in a country. It is hardly necessary to remark that the population is often due to circumstances unconnected with agriculture, and though it may induce intensive cultivation, the figures that would represent the agricultural produce would be diminished. Passing in review the total area of the country, the area utilised for farming purposes, and the area of enclosed lands, the author chooses the area of lands under cereals, and expresses the area under each crop in percentages of this area. There seems to us to be, at least, one very great objection to this standard when used in maps. This will be best illustrated by an example. In the map showing the area under barley, the largest expanse of the darkest shade (30 per cent. and more) lies over Norway, Sweden, and the north of Russia, conveying the impression that these countries are enormous producers of this cereal, while France is coloured in much lighter shades. The use of the total area as standard would give a more correct notion of the productiveness of a country, but it would not show how far the capabilities of the soil, such as they may be, are exploited by the inhabitants, and the area of the land utilised for farming purposes, besides being a fluctuating quantity, is open, though in a less degree, to the same objection, while with the enclosed lands as a basis, the same apparent anomaly referred to above in the case of barley would become prominent. The question is a difficult one to decide, but from the point of view of the geographical distribution of plants the total area of the country would be best. The contrast between fruitful and densely peopled districts on the one hand, and sterile and thinly peopled on the other, which would be brought out, and to which the author objects, is of importance; and the influence of climatic conditions would, perhaps, be more apparent. At any rate, whatever the standard area taken, a map should have been given showing its relation to the total area for comparison, and such a map of the areas under cereals would have given a good indication of the development of the agricultural industry in each country. Similarly in the maps showing the distribution of domestic animals, if the number of sheep were given per unit of area, instead of per 100 cattle, West Australia would not be coloured a darker shade than Queensland, but the great sheep-farming countries could be distinguished at a glance.

The distribution of about thirty crops is shown in as many maps, besides a few other plants which grow over a limited area; thus hops and chestnuts can be shown on the same map of Europe, as they are not

grown in the same countries, and rice, grown only in Italy and Sicily, does not come in contact with millet.

Several lines are added to convey additional information. Some limit the region within which more of one crop is grown than another, or where grass land exceeds the corn land by more than five per cent. Others show the Polar limits of certain crops and the isotherms which best indicate the temperature favourable to them. These are the isotherms for certain months, but Herr Engelbrecht is careful to point out that the climatic conditions on which a crop depends is generally the frequency or rarity of extremes rather than the mean temperature.

The limits of cultivation are often not easy to define. Commercial and social conditions frequently bring about great changes. The limit of vines has moved southwards, and barley is no longer grown on many less favourable lands in Norway. In England also the cultivation of wheat has declined owing to the imports from abroad. The Polar limit is not easily fixed, as the patches of cultivated land become gradually rarer towards the north, and the line will therefore depend on the smallest area that is taken into consideration.

Though the limits of cultivated plants must depend to a great extent on climate and soil, it is not to be expected that they will be so strictly determined by these conditions as the natural flora. One crop, as the author remarks, may be driven out by one which is found to be more profitable. Perhaps it may also be assumed that by cultivation a plant may be distributed beyond its natural limits, particularly to the north. Another disturbing cause is the increase of prosperity; to this cause, no doubt, is in some measure to be ascribed the trifling quantity of rye grown in the British Isles, and statistics regarding the cost of production and nutritive powers of the chief bread-stuffs might throw some additional light on their distribution. The changes that have taken place in quite recent years have, however, been unimportant, and the maps of Herr Engelbrecht therefore represent a fairly permanent state.

In treating of each individual crop, the author brings out a number of interesting facts. Of all cereals barley is the most capable of enduring extremes of temperature. It is the most extensively grown bread-stuff in the north of Norway and Russia and in Algeria. It can thrive in the Färoes and Shetlands, where storms and moisture prevents the growth of trees, and it occupies extensive areas in the extreme south of Italy, where no rain falls in summer. In Norway it is almost the only cereal found north of the 68th parallel, and north of the 64th to the east of the White Sea.

Oats flourish best in a moist sea climate, and therefore are most abundant in Ireland, Scotland, the west coast of Norway, and the south of Sweden. A mild winter and an early spring, a cool rainy summer with a mean July temperature not exceeding 57° F. are the most favourable climatic conditions. Towards the south of Russia the rain is insufficient and the heat too great in the beginning and middle of summer. Here the May isotherm of 59° and the July isotherm of 70° indicates roughly the southern limit of oats. South of a line from the mouth of the Garonne to the steppes of Podolia and thence along the 50th parallel, oats give way to maize and barley.

Herr Engelbrecht remarks on the similarity of climate demanded by certain crops and particular trees. Thus there seems to be a connection between the northern limit of winter wheat and that of the ash (*Fraxinus excelsior* F.). Probably early frosts in autumn are injurious to both alike, preventing the seeds of the tree from ripening and hence hindering its propagation, and retarding the growth of the wheat so that it has not attained its proper strength on the approach of winter. Again a mean January temperature of -10° F. seems to be the lowest that the ash can endure, while winter wheat is only found in scattered patches beyond this isotherm.

In North America the low temperatures experienced on the east coast down to comparatively low latitudes make themselves apparent, especially in the wheat map, bringing southwards the northern limit, while in the south cotton and rice occupy a large proportion of the land, where the damp sub-tropical climate is unfavourable to the growth of wheat. The low price of wheat during the decade 1880-90 caused a considerable restriction in its cultivation, and several changes in its distribution, at least of summer wheat, have taken place, in part due probably to the changes of population and their occupations. Maize naturally plays a much more important part in agriculture than it does in Europe, and $36\frac{1}{2}^{\circ}$ N. lat. is the approximate northern limit of cotton. The latter was formerly extensively grown in some of the Mediterranean lands, especially in Sicily, but now it appears only in the statistics of Malta, Greece, Cyprus, and Egypt. Another plant of limited cultivation in Europe is rice, which appears on the map only in the north of Italy, near Naples, and in Sicily.

Sufficient has been said to show what a mass of useful material is collected in these volumes for the use of the student, though only a very few details have been selected. Not only plants grown in large quantities, but even such garden vegetables as parsnips and artichokes, fodder crops, dye-stuffs, spices, grass land, etc., are all dealt with more or less fully. The maps of domestic animals also show the proportions of milch cows, horses, asses, pigs, and goats, of buffaloes in southern Europe and the Caucasus, and lamas in South America.

In conclusion the author makes a few general remarks on the zones of cultivation, which are represented for the whole world in the first map of the atlas. The other maps deal only with those countries in which statistics are compiled, whereas here the lines must be drawn from approximate data. Among other circumstances he notes that in the southern states of North America, as well as in Northern and Central China, the sub-tropical zone of the sugar-cane borders on the sub-tropical zone of cotton, where sugar and other tropical plants cannot thrive on account of the winter frosts, whereas in the southern hemisphere, where there are not such extreme annual variations of temperature, the sugar-cane zone extends up to what may be most conveniently called the maize zone. The northern limit of this plant, where it gives place to oats, is of great importance. The whole agricultural industry changes at this line; it marks the limit of dairy-farming southwards and the northern limit of swine-feeding on a large scale; it separates the domain of

sorghum from that of the sugar-maple; and here the sweet potato meets the Canadian pea and the buckwheat and hops of the northern latitudes. Many local variations are produced by climate, especially in Europe, where the irregularity of the coast-line causes great changes of climate within short distances.

ROBERT COX, D.L., M.P.

In the death of Robert Cox of Gorgie we have to mourn the loss of one who assisted at the formation of the Society, held more than one responsible office in its management, and always manifested a kindly interest in its proceedings. With characteristic hospitality he frequently entertained distinguished travellers and explorers who visited Edinburgh, and in many cases, as in that of the Arctic hero Greeley, this acquaintanceship ripened into friendship.

Robert Cox was born at Gorgie on 6th May 1845. The old mansion-house still stands in a pretty, secluded garden close to the highroad. The Cox family had for more than a century and a half been settled in various businesses on the Water of Leith. Robert Cox himself always maintained the Dutch origin of his folk, and jocularly claimed kinship with the Captain of the Night Watch in Rembrandt's famous picture. Certainly there has been no lack of learned theologians of that name in Holland. His grandfather married the sister of the philosopher George Combe, and their family showed much hereditary talent. There were five sons—Sir James Cox, one of the Lunacy Commissioners for Scotland; Robert Cox, W.S., the author of *Sabbath Laws and Duties*, *The Literature of the Sabbath Question*, and of the Index to the seventh edition of the *Encyclopædia Britannica* (one of the best bits of difficult work ever executed); Abram Cox, who practised medicine in the South of England; and John and George Cox, who conducted the Gorgie mills started by their father. George, who was the real author of the modern manufacture of "sparkling gelatine," was the father of our late member; but he died early, and young Robert had to fight his way through Loretto School and St. Andrews University without the support or guidance of a father. In 1874 he succeeded to the valuable business at Gorgie, which has greatly thriven and extended in his hands. He was ably supported by his veteran manager Mr. M'Cullagh; and by numerous visits to the United States he strengthened his hold upon that great market. Mr. Cox's relations with his workmen were always of a most harmonious kind: it may be said that at Gorgie one generation succeeds to another.

Mr. Cox had plenty of leisure for public life, and accordingly we find him serving in School Board, Parish Council, County Council, and Town Council, and upon the local Bench of Magistrates. He did not take a prominent lead in any of these departments of work, but his upright character and temperate judgment were always held in the highest respect. Mr. Cox had also warm sympathy with those institutions which make for light and culture in Edinburgh. He belonged to innumerable Societies. It is enough to record that he stepped forward

to take the place of his uncle, R. Cox, W.S., and his friend J. R. Findlay, at the Philosophical; he did much to found the Arts Club (which was opened by Mr. Hall Caine some years ago); and he was for many years intimately connected with the Amateur Orchestral. His love of music was great; he presented a noble organ to St. Cuthbert's Church, and his private collection included some valuable violins and 'cellos. He also took a deep though quiet interest in the affairs of the working classes; he belonged to many organisations for thrift and temperance, and often gave them good advice. But he despised the insincere flattery sometimes offered to working men. He was extremely tolerant in opinion. Thus, although himself a lifelong abstainer, he always, as a magistrate, opposed the fanatical section of the Temperance party. He was Chairman of the Health Society.

As to politics, although saturated with the philosophic radicalism of his family circle (he arranged for the publication of a Life of George Combe, and of a new edition of his works), Mr. Cox, owing to his profound distrust of the foreign policy of Mr. Gladstone, thought it his duty to act with the Conservative party in Midlothian. After 1886 he became a Liberal Unionist, and for some time conducted a vigorous campaign as probable candidate in West Aberdeenshire. In 1892 he contested the Kirkcaldy Burghs in a hearty and straightforward manner, which brought him many friends, and in 1895 he secured the seat at South Edinburgh against an experienced politician and able public speaker, Mr. Herbert Paul. This seat he held until his death on 2nd June 1899, and so much were his genial disposition, common sense, and conscientious discharge of local responsibilities appreciated by his constituents, that it is freely admitted on all hands that he would have retained the seat had he been permitted to come forward again.

There could be no more patriotic Lowland Scot than Mr. Cox. His attachment to his mother's county of Peebles was strong, but not so strong as his love of Edinburgh, of whose reputation as the intellectual capital of Scotland he was always jealous. He knew his Burns as few men do, and his reproductions of dialect were extremely good. He mourned over the decay of the "gude auld Scots." He loved the Church of Scotland, not only as a Church of Christ, but as a characteristic and venerable national institution. Two qualities of his character were very marked—sympathy with the distressed and hatred of hypocrisy. In 1875 he married Harriet Sophia, daughter of John Hughes Bennett, Professor of the Institutes of Medicine in the University of Edinburgh. He is survived by her and a family of six children.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

At a meeting of Council held on May 30th, Mr. David G. Dunn and Mr. David A. Hunter were elected members of the Society.

An ordinary Diploma of Fellowship was conferred on Mr. Hunter.

GEOGRAPHICAL NOTES.

By The Acting Editor.

EUROPE.

The English Channel.—In May Mr. Walter Garstang carried out the second of his periodical surveys of the biological and physical conditions of the western part of the English Channel. At the Ushant station, 50 miles west-north-west of Ushant, the temperature was found to be uniformly high from top to bottom (75 fathoms), but at all other stations a surface layer of warm water overlay a deeper mass of cooler water. This warm layer was 7 fathoms deep in Mounts Bay, 10 to 15 in mid-channel, and 15 to 20 over Parsons bank. The temperature at 5 fathoms was 53° F. in mid-channel, 53·2° in Mounts Bay, 54·1° off Ushant, and 54·5° at Parsons bank. Many interesting features in the vertical distribution of plankton were brought to light. Among the more interesting forms captured may be mentioned the medusa *Hybocodon prolifer* (mid-channel and Mounts Bay, 40 fathoms), the siphonophore *Agalmopsis* (Parsons bank, upper strata), the copepod *Isias* clavipes (Ushant, 3 fathoms), *Tornaria*, the larva of *Balanoglossus*, (Parsons bank, surface), and the eggs and larvæ of the pilchard (Ushant, 60 fathoms and at the surface at all stations except Mounts Bay).—*Nature*, June 15th.

An Ornithologist in Ushant.—Mr. W. Eagle Clarke was struck with the position of Ushant on the map, as apparently the point where migrating birds which have traversed the French shores of the Channel must change their course, and lying also on the course of birds passing to and fro between the Continent and the south-west coast of England. He therefore resolved to visit the island, and, accompanied by Mr. T. G. Laidlaw, arrived at the little port of Le Conquet, some 12 miles west of Brest, on September 7th, 1898.

A series of islands and innumerable islets, rocks, and reefs extends north-westwards from the Gulf of Brest and culminates in the comparatively large island of Ouessant, which we call Ushant. Through the numerous channels and passages a tide rushes at the rate of 14 knots an hour, which stirs up the surface of the sea into foaming whirlpools and rapids. In a three hours' run Mr. Clarke and his companion reached Ushant, the most westerly land of France, 12 miles from the nearest point of the mainland. The island is irregular in outline, for it throws out to the south-west two long arms which enclose the Bay of Porspaul, while there are minor promontories to the north-east, north, and north-west. Its area is about 3½ square miles. Cliffs face the sea on all sides except the south-west, attaining their maximum altitude of 211 feet in the north. The surface of the island has a parched and arid appearance due to the close cropping of the herbage by cattle and sheep. There are, however, several shallow, moist, and verdant depressions. Some corn is grown, and whins grow in enclosures, being protected because they are important as fuel. A few small trees grow in one or two of the gardens at Lampaul, the chief settlement, at the head of the bay of Porspaul.

The island is composed of foliated granite which does not form ledges in weathering, and hence probably the absence of breeding-stations of sea-fowl even on the sheltered eastern cliffs; those on the west and north are wave-swept, even in summer. The west coast is exposed to the full force of the Atlantic, and has been carved out into the most fantastic forms. The population is remarkably

large, over 2000. The men are engaged in the lobster fishery, and seem to be well-to-do, for the supply of these crustaceans on the submerged rocks around is practically inexhaustible.

There are two lighthouses on Ushant, the Phare du Stif in the north-east, and the Phare du Creach in the south-west.

Mr. Eagle Clarke and his companion hoped to remain several weeks on the island, but they had only been there six days when a gendarme appeared and followed them about wherever they went. The British Consul at Brest learned, on inquiry, that he had been sent by orders from Paris, though the French Government had been informed of the visit of the naturalists by the Foreign Office, and to prevent further annoyance the Consul advised Mr. Clarke to leave the island. It seems that the French have imagined that British agents are in the habit of bribing the islanders with a view to obtain pilots for these dangerous waters should war break out: the reward sent to the seamen who rendered great services at the wreck of the *Drummond Castle* is supposed to be part of the general system. Thus the examination of the birds was brought to a sudden termination.

Through the assistance of the British Consul, Mr. Clarke was, however, able to obtain much valuable information from the lighthouse keepers. Their reports show that the island is visited annually by vast numbers of birds of passage, and many are killed at the lantern. The head keeper of the Phare du Creach stated that on one night in the autumn of 1888 no fewer than 1500 birds perished by striking the lantern, and the engineer confirmed the truth of the statement. The great flights are observed towards the end of autumn. In the spring there are fewer migrants; but these consist of the same species. In winters of great cold and when the mainland is covered with snow, large numbers of birds visit the island. Ravens and several small birds nest there annually. The inquiry has proved that Ushant is of first-rate importance as an observatory for witnessing the movements of migratory birds.

Their stay at Ushant being cut short, the two ornithologists betook themselves to Alderney. It is singularly destitute of trees, and therefore many of our common birds are absent or rare. Some of the notes made by Mr. Clarke were at variance with the experience of the late Mr. Cecil Smith, who wrote the very useful little book, *The Birds of Guernsey and Neighbouring Islands of Alderney, etc.*—*Ibis*, April.

AFRICA.

The Foureau-Lamy Expedition.—From the wadi Affattakha (25° 19′ N. lat., 7° 36′ 27″ E. long.) M. Foureau crossed the Tindesset over difficult country composed of sandstone rock, where the caravan had to ascend to heights of 4600 feet. The wadi Affattakha is in the basin of the Igharghar, and the country around is volcanic. Tindesset is the name given to the western part of the Tassili of the Ajer. Southwards extends the Adrar dominated by high peaks, among them being the Télut or Télit, a volcanic peak 5900 feet high. The map of Duveyrier shows correctly the succession of the wadis, wells, and other important points, but the longitudes are not always quite correct. At the end of the year some very severe weather was experienced, minima of 18° and 14° F. being several times recorded.

Tadent, on the route from Ghat to the Aïr, lies in lat. 23° N. and long. 7° 50′ E. beyond the Anahef, a mountainous region with lofty arid ridges where there is very little water and vegetation. It is composed of granite and gneiss, with schists at the base and masses of quartz. The watershed between the Mediterranean and Atlantic was passed on January 9th, on Mt. Ahorrene, at an

altitude of 4470 feet, and 125 miles farther south the watershed between the affluents of the Taffassasset and those of the wadi Tadent, having the same elevation. Here the vegetation becomes a little more abundant and Tuareg encamp near the wells. MM. Lamy and Foureau visited the well Tajenut (not called Bir-el-Gharama), where Colonel Flatters was massacred. It is situated 87 miles west-north-west of Tadent. Between Tadent and In-Azaua the caravan made a trying march across desert where there was little water and no vegetation. At Tadent the elevation is 3900 feet; it sinks gradually towards the south, and at 2100 feet sandstone makes its appearance, displacing the granite. The well of Assiu is almost dry, and that of In-Azaua has taken its place as a supply for caravans. Both are situated in the wadi Taffassasset, which drains all the eastern flank of the Anahef from the parallel of 24° 30′ N. In-Azaua is at the junction of the Taffassasset and Tadent, the latter receiving part of the waters from the western side of Anahef. The united wadis run south-south-west, receiving the Tin-Tarabin and several other tributaries, and takes the name of Tamanghasset and then of Igharghar-Mellel. The nearest villages of the Aïr are distant about 10 days' march from In-Azaua, and the intervening country is favourable for travelling, as vegetation reappears about 50 miles from the well.

According to later reports from Tripoli, the expedition has reached the northern boundary of the Aïr, and defeated the Tuaregs. Having obtained provisions and camels it started towards Agades, the chief village in the oasis.—*Comptes Rendus* of the Paris Geogr. Soc., No. 3.

Water in the Sahara.—Owing simply to the fact that Ouargla is included in the department of Algiers, caravans generally take the route by the Mzab and Laghouat, which is provided with a succession of wells kept in good repair. But commercial relations have always existed with Biskra, for the long and regular depression of the Wed Ghir and Wed Mya present a natural and convenient highway. Last year seventy wells were sunk or repaired in a straight line between Ouargla and Tougourt, a distance of about 105 miles, and by this route M. Lahache travelled with a detachment of troops. The way led across a succession of dry shotts and over low sandy ridges (not more than 16 feet high), the whole surface being composed of Quaternary alluvium. Three elevations left by erosion are particularly noticeable—the Dra-el-Kesdir, El Hadjira, and Chabet-Lakdar (100 feet high). An inspection of these and of the shotts at their feet leads to the conviction that the Wed Mya formerly communicated with the Igharghar by innumerable channels intersecting the plain between Ouargla and Tougourt. Whether the water flowed from the Mya to the Igharghar, or in the opposite direction, is not easily decided, for the difference of level between Tougourt and Ouargla is only some 160 feet, and the upper course of the Igharghar in the latitude of Ouargla is also at nearly the same level as Tougourt.

M. Lahache observes that the sand dunes have accumulated in directions that do not correspond to the underlying formations, and that it is impossible, as some observers have maintained, to deduce the strike of the latter from the surface configuration. An examination of the surface would lead to a belief in the independence of the basins of Ouargla, Ngoussa, Baghdad, etc., and the composition of the waters has been appealed to in justification of the theory. The quantities, however, of the various salts contained in the waters are much the same everywhere, and the water is the purest and most uniform along the course of the Wed Mya between Ouargla and Tougourt. The acceleration or retardation of the flow of water, local infiltration, evaporation, and other causes, may sometimes produce differences in the contents.

M. Lahache has on several occasions demonstrated the southern origin of the deep waters of the Wed Ghir, while other specialists have tried to show that the subsoil water between Biskra and Tougourt comes from the north, and have maintained that it is, therefore, lost labour to sink artesian wells to the south of Ouargla, and in the arid defiles of the Erg. Last year, however, at Hassi Mokhanza in the Gassi Tuil, 125 miles south of Ouargla, one of the arteries which brings water from the Ahoggar mountains to the Wed Ghir was tapped at a depth of 140 feet. The water is excellent, and the supply inexhaustible, and the experience proves that springs may be opened along the route to Timassinin.—*Revue Scientifique*, May 27th.

Morocco.—Dr. Th. Fischer, who has been travelling in this country, has communicated by letter a few of his observations to the Gesellschaft für Erdkunde zu Berlin (*Verh.*, Bd. xxvi. No. 4). The foreland of the Atlas mountains is, he says, a block elevation, consisting, indeed, for the most part of horizontal strata, and the dominion of the Sultan, as of all former masters from the Romans downwards, has always been restricted to this region, where there are no natural strongholds, while the folded elevations of the Atlas have been the home of independent Berbers. No trace of folding was observed along the whole coast from Tangiers to Mogador, or along the Tensift valley from the mouth to Morocco city. One special object of Dr. Fischer's journey was the exploration of the Tensift, the course of which has been laid down quite arbitrarily. He followed it for five days, from the point where it enters by a rocky portal into the plain of El Hamr, near its estuary, to the city of Morocco. The bays eroded by the river have often very steep sides, which forced the caravan to cross the river and make its way over the low peninsula opposite. In one part of the journey the river had to be crossed five times in two hours. Fortunately the water was low, for in the Tensift valley it had rained very little during the winter, and the snow on the Atlas had not begun to thaw. Consequently the bush steppe, that begins about 25 to 30 miles from the coast, was more than usually dreary. On one day's march only two miserable *duars* were seen, with fewer than 100 inhabitants between them. After irrigating numerous oases in the Morocco basin, the Tensift flows through some 60 miles of this steppe, where only here and there an attempt has been made to irrigate in a rough and ready fashion some small patch of land.

Dr. Fischer also made a voyage along the coast from Tangiers to Mogador for the purpose of hydrographical observations, in which he was much hindered by the stormy weather and surge so common on this coast. Though he wrote on April 6th, he had already recorded a temperature of 95° in the shade.

The Nyassa-Tanganika Plateau.—Papers on this country are published in the *Geographical Journal* for June. Captain Boileau, R.E., who has written the first, was a member of the Anglo-German Boundary Commission in 1898, of which Captain Close was the chief British commissioner. The telegraph line had been carried northwards to a point near Nkata Bay, about 140 miles south of Karonga, and signals from the Cape Observatory were used to fix the longitude. A pillar was set up in the middle of the telegraph clearing in long. 2 h. 17 m. 7·6 s. E. of Greenwich, which should henceforth be treated as a fixed point in this part of Africa. The error of longitude is not likely to be more than one-twentieth of a second. The position given in a map in the December number of the *Journal*, from the observations of Lieuts. E. L. Rhoades and W. B. Phillips, agrees as nearly as the scale will show with this value, and hence the received longitude of Blantyre, fixed by Mr. O'Neill in 1884 from a very large number of lunar distances, and on which all the longitudes of

British Central Africa have hitherto depended, is probably satisfactory. Between July 11th and October 20th a series of triangles was extended from Karonga to a point at Kituta, on Lake Tanganika, which was found to be in lat. 9° 21′ 11″ S., and long. 32° 59′ 27″ E. In a short note on the heights of the two lakes Captain Close shows that for Tanganika the mean of several determinations by German and British travellers is 2713 ± 23 feet, while for Nyassa it is 1651 ± 30, the observations of the British delimitation commission being included. The difference of level of the two lakes by barometric determinations is 1062 ± 38 feet. The difference of these levels by the triangulation carried out by the British party was 935 ± 22 feet. The weighted mean is 980 feet, which may be taken as the probable difference of level. The errors in the heights of Nyassa and Tanganika are 46 feet and 36 feet respectively, so the height of Nyassa above sea-level is 1700 feet, and of Tanganika 2680 feet.

Mr. L. A. Wallace gives an account of his wanderings through the country, principally in pursuit of game. One of his most interesting excursions was to Lake Rukwa or Hikwa, which had never been thoroughly explored before. Mr. Wallace followed the course of the river Saisi, which rises near the highest part of the Tanganika plateau, in Mt. Sunzu, 6889 feet high, and about 70 miles from its source descends 2000 to 3000 feet in cascades to the Rukwa plain. From the foot of the hills it runs in a gully about 40 miles and a quarter to half a mile, and 100 feet deep, and then falls into the north-west corner of the lake through swamp and jungle at the village of Senga. He then marched 45 miles south-eastwards, to the river Songwe, passing two streams which contribute water to the lake only in the rainy season. The water of the lake was shallow, very dirty and salt, but the lions and other game, which were very plentiful, seem to drink it, for there were well-worn tracks down to the shore. Sir Harry Johnston and Dr. Cross reached the mouth of the Songwe and gained the impression that the whole lake was surrounded by an impenetrable belt of reeds ; but there is no dense belt of reeds except at the mouth of the river. On the north-east the water ends at a sandy beach, or at the base of cliffs rising, sometimes nearly perpendicularly, to a height of 450 feet. These hills begin close to the right bank of the Songwe and extend in an unbroken line for 100 miles. For the first 20 miles from the Songwe the Rukwa washes the foot of the hills, but at the village of Chiubi the water ends and is succeeded by an extensive grass plain, where there were numerous dry water-courses, the largest of which comes from Mt. Ilomo and during the summer carries a great deal of water into the lake. At the village of Ntiwiri the plain can be crossed ; more to the south-east it can indeed be crossed sometimes, but with difficulty, owing to too much water at some places and the total absence of it in others. Five miles from the village the grass ends, giving place to bare, level ground, the dried-up bed of the Rukwa. The western side of this plain was reached at Uchiya, about 10 miles from the mountains from which, 80 miles to the south-east, the Saisi descends to the plain. These mountains form the edge of the Tanganika plateau, and run nearly parallel to the hills skirting Lake Rukwa on the east, but rise to a much greater height, 3000 feet or more above the plain, while the bare rocky peaks of Memia, Kusa, and Nkukwe are nearly 1000 feet higher. Rukwa is the name generally used on the plateau, and probably applies to the whole plain, while Hikwa is almost invariably employed at the lake itself, and seems to refer to the open water and flooded land only.

After leaving Rukwa, Mr. Wallace went to Mweru marsh, 40 miles east of Lake Mweru. It is a large, generally swampy, plain, 3000 feet above sea-level, about 35 geographical miles in length from north to south, and 10 to 15 miles broad. It is bounded by steep hills on the east, and by equally well-defined hills, though less

abrupt, on the western side. On the south-east the hills rise in some places 800 feet or more above the plain, and close under them are many hot springs at a temperature of 115° F. The water is clear, odourless, and tasteless. The Mweru marsh receives the rivers Mkubwe and Mwambezi on the south, and Chomo and Chisera on the north, the first three running all the year. The outlet is down the Mofwe plain to the river Kalongwisi and Lake Mweru. Where the water has lain in shallow pools and then dried up, a thin crust of salt is left on the surface of the soil. This is collected and the salt washed out and sold to natives, of whom many come from long distances, 15,000 to 20,000 lbs. being exported annually.

Mr. Wallace saw nothing that led him to suppose that either the Rukwa lake or the Mweru swamp is permanently drying up. The latter was full in 1867, from 1894 to 1897 it was drying up, but in 1898 it was filled once more. In Tanganika the water rose from 1871 to between 1876 and 1886 and then fell up to 1890, since when it has been stationary.

The plateau south of Tanganika contains 25,000 to 30,000 sq. miles of country over 4000 feet above sea-level, 10,000 of which lie between 5000 and 7000 feet. The climate is dry and subject to no great fluctuations of temperature. Malaria certainly exists, but it is not virulent, and black-water fever has carried off a large proportion of the few white inhabitants, but on the whole the country is not unsuitable for Europeans, who might enrich themselves by the cultivation of such valuable products as indiarubber.

Dr. Passarge in Ngamiland.—Dr. S. Passarge was engaged in 1896 by an English company, of which Col. Lugard is a director, to examine this country, now called West Charter Land, for minerals. There are routes across the Kalahari from Mafeking and Molopole, but both pass through such extensive waterless tracts that it was quite out of the question to attempt the journey with asses, which had to be used as oxen were very scarce in consequence of the cattle plague. Even from Palapye the undertaking was attended with risks, though Colonel Lugard had succeeded in reaching the Botletli river and the Ngami lake with six donkey carts. The distance from Palapye to the Botletli is 250 miles, and Mungungwe (Makala on maps?), the last well before the Kalahari is entered, is 164 miles from the river. Almost the whole of the Kalahari is covered with sand, and rock is seen only here and there in fragments of lime and sandstone. In certain places the rock is exposed, forming roundish shallow hollows; these are the pans, called *lecha* by the Bechuanas. Formerly these hollows were filled with water, as a few, the Ghanze pan among them, are to-day. As the water disappeared from the surface, wells were sunk, and water is generally found at a depth of 14 to 20 feet, in most cases in sandstone overlaid occasionally by a stratum of limestone.

Donkeys travel very slowly—two miles on hard ground, and only one to one and a half over sand—and therefore much forethought is necessary in conducting a caravan across the desert. Mules travel more quickly, but do not endure thirst so well. When Dr. Passarge left Palapye, on September 30th, 1896, the waterless stages were of moderate length, the longest being 54 miles, from Malachuai to Tklakani, whereas now, the wells at Missa and Mungungwe being dry, there is no water from Palapye to Inhauani, a distance of 81 miles.

In the dry season the Kalahari has a very desolate appearance. The country is flat or undulating, and covered with reddish sand and low unsightly brush. But in the rainy season it is all green, flowers in thousands cover the ground, the grass is luxuriant, and numerous pools (vleys) enable the Bechuanas to establish grazing stations.

The salt pans, the first of which is called Chukutsa, belong to the series that follows the lower course of the Botletli, or, rather, the river loses itself in the salt

pans, the largest being the great Makarikari. These pans are roundish or oval basins, some miles in diameter, sunk in the sandstone to a depth of 30 to 50 feet. While the central basins are filled with water, or at least with reeds, those on the outskirts, Chukutsa included, are quite dry. In August, when the water in the Botletli is high, all the pans are sometimes filled. At the village of the chief Pompi the reed swamps of the Botletli are reached and the scenery completely changes; instead of the yellow desolate steppe, there are beds of reeds traversed by old river beds. The bed of the Botletli is 160 to 220 yards broad, but the river itself is only 30 to 55 yards broad, and is lined with a wide strip of reeds. The banks of sand, cemented together with lime, are 25 to 30 feet high, and their white colour contrasts agreeably with the green of the foliage. Water birds are very plentiful as well as fish, and animal life is abundant in the woods on the banks; lions are numerous, but the antelopes are fewer owing to the plague, and also the waterbucks.

A noteworthy point is the confluence of the Tamalakan, a river which rises in the swamps of the Okavango, and apparently breaks through a low undulation skirting the Ngami basin on the north-east side. Tamalakan, as well as Ngami lake and river, and Botletli, are names introduced by Europeans, and unknown to the native Bushmen or denoting only districts or tribes. From the Tamalakan the Botletli river ceases to be continuous, and is represented only by isolated pools up to the Ngami lake.

As for the lake itself, the broad sheet of water, the far-stretching green swamps with reeds and papyrus seen by the first discoverers, have vanished, and only a brown expanse of dead reeds remains, where care must be taken in walking over the yielding soil of clay and ashes. There is still water below the surface, but the wells are generally about 20 feet deep, and the water often brackish. The river Taukhe, which used to pour its waters into the lake, and which Andersson describes as deep, though not very broad, is now dry for a distance of some 20 miles north of the lake, and the lake has been for some time drying up, especially during the last ten years, since the Taukhe has entirely ceased to feed it. The failure of the Taukhe is connected with the shrinking of the Okavango and with the general drying up of Central South Africa, but its immediate cause has been the thousands of reed rafts on which the Makoba used to carry their annual tribute of corn to the Batauana capital, Denikani, and which they left in the bed above the town, at the point where the river ceased to be navigable. With the disappearance of the water agriculture became impossible, and the numerous villages on the banks have been deserted.

On December 25th Dr. Passarge reached the Kwebi hills, where the headquarters of the expedition under Colonel Lugard had been established. Extending to a length of about 12 miles, and rising to a height of 650 feet, these hills were formerly well watered when the Bamangwato settled among them, and subdued the Bakalahari, the former lords of the country, but now most of the wells are dried up. The round pointed summits rise like islands from the desert, and are clothed with wood, the stony soil retaining the water longer than the Kalahari sand. The most conspicuous tree is the baobab; perhaps nowhere in the whole of Africa is it found in such numbers.

At Christmas 1897, Dr. Passarge made an excursion from Ghanzi to the Gam district west of the lake. The first stage on the way was a dry river bed, the Groot Laagte, forming a valley 100 to 230 yards broad. Sometimes it expands into broad flats, formerly lakes through which flowed a tributary to the Ngami lake. Baines and Chapman visited its lower part, and named it Bell Valley. Having examined the Gam district and the extensive highlands of Kaikai, con-

sisting of numerous ridges and hills of limestone, Dr. Passarge pushed on to the Okavango, meeting with great difficulties among the natives, for the different tribes of Bushmen are constantly at feud with one another. On reaching Sodanna he descended a dry river bed to the Shadune spring, and then made straight east to the Taukhe river, which he found to be not 10 miles distant, as in Langhans' map, but 70. The bed of the stream is cut out of a mass of grauwacke down to the Popa falls; below it divides into branches, and reed and papyrus swamps grow more and more extensive. The route to the Ngami lake passes through an immense network of old river beds, the granary of the country inhabited by the Bantu tribe Makoba, which has been enslaved by the Batauana.—*Verh. der Gesell. für Erdkunde zu Berlin*, No. 4.

Brava.—Little is heard of the Italian territory on the Benadir coast, and at present there is apparently little to report. Signor G. Mamimi gives a slight sketch of the neighbourhood of Brava in *L'Esplorazione Commerciale*, Anno xiv., Fasc. 2-3. From the summit of the hill of Brava the enormous plain of the Somali country looks like a sea, dreary and monotonous. A little beyond the hill the traveller comes to the Webi Gofca, a branch of the Shebeli, which was dried up some twenty years ago by the Bimal Somali, who closed its upper end where it leaves the main stream. The bed of the Gofca lies in a zone about two hours' march in breadth, composed of dark grey alluvium, which is very fertile and is still cultivated by the people of Brava in the rainy season. Numerous villages are situated along the river bed, in which dwell a few slaves occupied in agriculture and a large number of pastoral Tuni Somali. In the season there are some good pasture lands near the villages and tall vegetation, the baobab and certain umbelliferae being conspicuous. During the dry season the cattle are driven to the Shebeli, which even then overflows its banks. The territory will be capable of producing cotton, sesamum, and corn in abundance, when the Webi Gofca is reopened, bringing a supply of water which must be conducted through the fields, and relieving the Shebeli, which will also need embankments to protect the crops. At present cultivation is impossible near the river owing to the floods.

The natives of Brava are of mild disposition and wanting in energy, so that they were quite paralysed by the closing of the Gofca. Their slaves, who were the first to feel the effect of the failure of the crops, fled to the sultanate of Gusha, where they became free. The Tuni made haste to sell their slaves to the tribes inland and to the north. In consequence agriculture is now confined to the villages on the Gofca, while the Tuni have returned to grazing.

In the Brava territory life and property are secure. The Tuni, having lost their slaves, are unable to make use of their vast territory, and would willingly part with most of it to Italians, even without compensation, for their pride would suffer more were their land to pass into the hands of other Somali tribes. An Italian company would gain handsome profits, especially from the cultivation of cotton. The climate is healthy, the temperature even, and provisions cheap, a fine cow costing only £2. Should it be thought inadvisable to reopen the Gofca for fear of disputes with the Bimal, still the belt beside the Soblalle (the main channel of the Shebeli) might be rendered cultivable by embanking the river and constructing some simple hydraulic works.

The Lake of Ashanti.—It has long been known that there is a lake in Ashanti, the only one near the Guinea coast. At length a missionary, M. E. Perregaux, who has visited it, has given a short account of it in the *Bull. de la Soc. Neuchâteloise de Géographie*, tome xi. The shores are so densely clothed with tall grass, wild sugar cane, and bananas that no glimpse of the water is obtained from the path,

though it runs close beside it. Obosomtwe, as the lake is called, lies a long day's march to the south-east of Kumassi, and is marked on the map in vol. xii. p. 20 by the name of Busumakwe. It is three to four miles long by about one in breadth. It swarms with fish, which are caught in nets by the natives, who live in more than twenty villages along the banks. There is also a large floating population, servants of the Ashanti chiefs, who come to catch or buy fish for their masters. The lake is divided among the several groups of fishermen, and strict laws forbid any encroachment on the domain of another village. The lake being regarded as fetich, no canoes are allowed on it, but to drive the fish into the net the natives employ beams of wood five or six feet long, on which they sit astride, paddling with their hands. The huts are of wattle, covered with leaves, for the water is continually rising, and after a few years the natives have to move their dwellings farther back. The lake has no emissary, and the evaporation is insufficient to carry off the water that runs in from all sides. The natives say that about every other year a singular ebullition occurs in the lake, accompanied by a dull detonation, and that then thousands of fish may be picked up lying on their backs in the water. This phenomenon, and the odour of sulphur sometimes observable, seem to indicate that the lake is of volcanic origin.

AMERICA.

The Disputed Territory south of French Guiana.—The question of the possession of certain lands south of the Guianas has been alluded to more than once in the *Magazine* (see vol. xi. p. 198). It may be remembered that the French claim the country southwards to the Araguary and westwards to the Rio Branco, while the Brazilians place the boundary at the river Oyapock. In the *Comptes Rendus*, No. 3, of the Paris Geographical Society, M. Georges Brousseau gives a few notes on this territory, which he estimates as covering about 100,000 square miles, with a coast-line of 280 miles. The circumstance which first drew the attention of the French to the country was the discovery of gold in 1894 along the river Carsevenne and the consequent rush of miners to that river. The highest mountains are in the Lombard chain and in the Pripupu (1500 to 1600 feet), a continuation of the Tumuc-Humac mountains. Another low chain or plateau, about 800 feet high, skirts the left bank of the Araguary. The whole region is abundantly watered by a number of rivers and brooks. The Atlantic littoral is constantly exposed to the south-east and north-east trade winds, which cool the air and carry rain inland to the edge of the plateaus. During two years the wind was never observed to blow from the west. The rainy season lasts from February 15th to August 15th, and the dry from August 15th to February 15th. The mean day temperature on the coast is 79° to 81°, and 72° in the mountains, where the thermometer not infrequently falls at night to 59°. The climate is decidedly healthy, and yellow fever and smallpox, so common at Para and on the Amazon valley, have never appeared here. A granitoid gneiss extends over nearly a third of the disputed territory, and upon it lie shales, conglomerate, and ferruginous sandstone. This system is traversed in all directions by dykes of diorite and diabase full of veins and threads of quartz, very rich in gold.

The population between the Oyapock and Araguary numbers about 7600. In the north, in the basin of the Onassa, about 600 Indians live, dwelling in the rainy season on the islets left by the wide-spreading inundations that cover the whole country. At Cachipour, Brazilians and half-castes form the majority of the inhabitants. Counani is a town of 350 to 403 inhabitants, situated on the left bank of a river of the same name, and is the rendezvous for fishing-boats from Para and the islands of the Amazon. The Carsevenne is a river rather larger

than the Charente. It has a spacious mouth, but meanders and banks of sand and mud render its navigation difficult; hence provisions for the miners are carried up by porters.

The finest part of the country lies to the south of the Carsevenne. It now contains 1800 to 2000 inhabitants—Portuguese, Brazilians, and half-breeds, and could easily support a million colonists—fishermen, agriculturists, and miners. Starting from Mapa, the traveller finds himself in the midst of savannahs and lakes, whatever direction he takes, where the inhabitants can support themselves comfortably on fishing and hunting. Besides gold, coal also exists, but in what quantity it is not possible to determine at present. India-rubber is everywhere, and cabinet wood is abundant. Grazing is carried on extensively in some parts, and manioc, bananas, coffee, and cocoa are cultivated.

Chilian-Argentine Boundary.—Besides the question of the boundary in the southern part of Chile and Patagonia, the possession of the Puna de Atacama has been disputed between the two countries. As there was no prospect of the conference which met in March last coming to an agreement, the matter was referred to the ambassador of the United States in Buenos Aires, Mr. Buchanan, who on March 25th decided that the disputed territory should be divided between the two republics. The boundary begins at the point where the parallel of 23° S. lat. cuts the meridian of 67° W. long., to the south of the hills of Zapaleri. It then runs in a straight line nearly due south to the summit of the Rincon, and thence south-westwards to the summit of the volcano of Socompa. It continues in the same direction to the Aguas Blancas of Argentine maps, and then crosses over the Cerros Colorados and passes the Laguna Brava to the Sierra Nevada, whence it runs in a straight line to a point on the parallel of 26° 52′ 45″ S. This decision is unfavourable to Chile, as the larger half of the Puna falls to Argentina, and the eastern half is the more valuable, containing several small settlements and well-watered pasture lands.—*Geogr. Zeitschrift*, Heft 5.

OCEANS AND GENERAL.

The "Valdivia" in Antarctic Waters.—The expedition under the leadership of Professor Chun returned to Hamburg on April 30th. A summary of the work done by it in the Antarctic Ocean, translated from the *Deutsche Reichsanzeiger*, is published in the *Geographical Journal*, June. The centre of Bouvet island is in lat. 54° 26·4′ S., and long. 3° 24·2′ E., and the length of the island is 5·1 nautical miles from west to east, and the breadth 4·3 miles from north to south. About the same size as New Amsterdam, Bouvet is likewise of volcanic origin. The highest point of its crater rim (3067 feet) was named Kaiser Wilhelm peak, and the northernmost of the five projecting angles of the island Cape Valdivia. The whole is covered with one vast glacier, which on the gently sloping southern and eastern sides reaches the sea, forming an ice-wall 400 feet high. Bouvet and Lindsay reported trees on the island, but no trace of vegetation could be seen from the *Valdivia*. Animal life also appeared to be extremely scarce, in contrast to other Antarctic islands. In the lee of the island, and at a distance of three to four nautical miles, depths of 200 to 300 fathoms were sounded, and very rich hauls of the dredge were made. Every group of marine organisms, except fishes and stalked crinoids, was represented. Norris reported that forty-five miles north-north-east of Liverpool island (probably identical with Bouvet island) was another which he named Thompson island. This was searched for in vain, and Professor Chun believes that Bouvet's Cap de la Circoncision, Lindsay island, and Liverpool island are all identical with the rediscovered land.

The great depths sounded after leaving Bouvet island are one of the most surprising results of the expedition (see chart in the March number of the *S.G.M.*). To the fifteen soundings previously made south of lat. 50° S., the expedition added twenty nine, and showed that the Southern ocean is of very great depth. On December 17th, in a depth of 2535 fathoms, the large trawl collected large quantities of stones, which had dropped from melting icebergs. They included specimens of gneiss, granite, and schist, besides a mass of red sandstone, weighing five cwt., one side of which, evidently so far as it had been embedded in the ooze, was stained blackish. The absence of volcanic rocks shows that Enderby Land is not of volcanic origin, though its submarine slope is steep. The six soundings taken between Enderby Land and Kerguelen show that the sea bottom is strongly folded, depths of 1300 fathoms alternating with great depths of 2000 to 3000 fathoms.

The most interesting temperature series was taken at the edge of the Antarctic ice, as it shows a stratum of warm water nearly 1000 fathoms thick, underlying the icy water of the surface layers. The lower parts of icebergs dipping into this warm water must melt rapidly even in the Antarctic area. In the section through the south-east trade-wind region of the Indian Ocean, the *Sprungschicht* or zone of rapid change of temperature occurs at 100 to 150 fathoms, so that the great heating of the water in the tropical zone is quite superficial. At 250 fathoms the temperature is much the same as in the temperate zone.

Vertical tow-nets were lowered to 1600 fathoms, and often brought up surprising quantities of material. Many of the forms of life obtained from the cold, deep layers in the Tropics were found again in water of the same temperature at the farthest south. From the surface down to 1000 fathoms in the Antarctic, the number of floating organisms is very considerable, and even from between 2400 and 2700 fathoms (in 59° S.) four genera of living copepods, a living ostracod, and several radiolarians were brought up by the tow-net. The plankton of the Antarctic Ocean is characterised by a great abundance of diatoms. The northern limit of the diatom region was crossed in the Atlantic and Indian Oceans at about lat. 40° S., and corresponded with a sudden fall of temperature. Forms characteristic of warmer regions occurred as far as 50° S.

Ice-Breaking and Ice-Breakers.—The *Annalen der Hydrographie*, Heft 4, contains a translation of a lecture by Admiral S. O. Makarof on the subject of forcing a passage through ice. The first ice-breaker, as the editor states in a footnote, was a wooden paddle-steamer named the *Relief*, which was employed at Baltimore in 1854 to break ice by steaming against it. In Russia, however, much attention has been given to the question of late years. The Kronstadt merchant Britnef built in 1864 the steamer *Pilot* with a slightly sloping bow, so that it could run on to the ice and break it. This vessel kept open a passage between Kronstadt and the mainland for some weeks longer than usual. Another method was tested in 1866. Weights were allowed to fall on to the ice from the bow of a gunboat, which indeed broke the ice, but the gunboat was too weak to thrust aside the blocks. The winter of 1870-71 was unusually severe, and the port of Hamburg was frozen up, and ice-breakers were constructed, Britnef's plans being bought. Lübeck followed the example of Hamburg, and soon all the harbours of the Baltic were provided with them. Ice-breakers also commenced work at Nikolaief in 1891, and at Vladivostok in 1892. When the construction of the Siberian railway was commenced, and the great expense of carrying the line round the Baikal lake was discussed, it was resolved to place an ice-breaker on the lake. This was built on the plan of those used in America, which have a screw in front. The

advantage of this arrangement was discovered by accident. One of the captains found that a hummock resisted the attack of the ice-breaker, but that when the wash of the screw was turned on it, the lower part began to loosen, and presently the whole fell to pieces. Probably the lower blocks were but loosely knit together. The screw has proved very successful on Lake Baikal. As long as the ice-breaker is moving through ordinary ice the bow-screw assists in breaking it by sucking out the water from below; but when a large compact hummock is encountered, the screw is revolved in the opposite direction, so as to send a stream of water against the lower blocks and loosen them.

Weyprecht, in his *Metamorphosen des Polareises*, determines the relation between frost and the thickness of the ice. From observations at three different places he compiled a table, in which the cold is measured by degree-days, the Réaumur scale being used. From this the following figures are taken:—

500°	produced ice	63 cm.	thick.
1000°	,,	92	,,
2000°	,,	134	,,
3000°	,,	165	,,
4000°	,,	189	,,
5000°	,,	209	,,
10,000°	,,	294	,,
15,000°	,,	359	,,
20,000°	,,	410	,,

Thus the thickness of the ice-sheet increases very quickly at first, and afterwards exceedingly slowly. While the first 500 degree-days (1125 F.) produce a thickness of 63 cm. (nearly 25 inches), the last 500 produce only 5 cm. (2 inches). Weyprecht calculates the mean amount of frost in the Arctic Ocean as 4500 degree-days (10,125 F.). The melting proceeds in a different manner. It becomes more rapid as the ice becomes thinner, especially from the time when the ice becomes porous. According to Weyprecht, the thickness of the ice in the coldest part of the Arctic Ocean may diminish by 1 to 1·5 m. during the summer. Supposing, then, that the amount of frost is 5000 degree-days, and the melting 1 m., in the winter ice 209 cm. thick will be produced, while in the summer 1 mètre will be melted, so that 109 cm. will be left, equivalent to 1350 degree-days. For the second winter 5000 degree-days must be added, making in all 6350, which correspond to a sheet of ice 234 cm. thick. Proceeding in this way, we find the maximum thickness to be 260 cm. (8½ feet). On the *Fram* the frost recorded was 5130 degree-days during the first winter, 6130 in the second, and 5300 in the third, the mean being 5520. Nansen reports that in one summer the melting amounted to one mètre, which with 6000 degree-days of frost would give 3·05 m. as the maximum thickness of ice according to Weyprecht's formula. Nansen, however, met with ice 3·66 m. (12 feet thick), and De Long also speaks of such ice. Whether this is an exceptional experience or not, ice-breakers should be able to contend against ice 12 feet thick.

The marine engineer Afonasief gives a formula connecting the power of the engine of an ice-breaker and the thickness of the ice to be broken. It is I.H.P. = $2{\cdot}5\ vd^2$, where I.H.P. is the indicated horse-power of the machine, v the velocity of the vessel in knots, and d the thickness of the ice-pack in inches. Thus, to move at the rate of one knot through ice 2 feet thick would require 1440 horse-power; through 4 feet of ice 5760; through 6 feet, 13,000; and through 12 feet, 52,000. Messrs. Armstrong's estimates were much lower, but they applied to ice-breakers provided with a screw in front. Besides floe-ice, hummocks have

to be reckoned with, which seldom exceed 25 feet in height, while they occasionally descend as far as 40 feet below the surface. From the experience of ice-breakers on Lake Michigan it appears, however, that these are far more easily shattered than ice 12 feet thick can be broken up. The bursting of sea-ice with a rise of temperature, and its greater brittleness compared with fresh-water ice, are also favourable to Admiral Makarof's enterprise.

Admiral Makarof still believes in the existence of the open Polar sea (Polynia) of Wrangell, and finds some confirmation in the temperature observations of Nansen in lat. 82°, long. 125° E. Down to about 55 fathoms the temperature was nearly the same, about 29° F., and then gradually rose, attaining 32·6° at 140 fathoms; at 270 fathoms the temperature again began to sink, and at 985 fathoms was 30·9°, which was the temperature down to the bottom. Unfortunately the specific gravity of the water is not given, but the warmer water must be salter than the surface water or it would rise, and therefore it no doubt comes from southern latitudes. Therefore Admiral Makarof thinks that there must be currents similar to those in the Bosporus, the warmer salter water flowing in from the Atlantic below, and the colder water passing out of the Arctic seas carrying the ice with it. Between 55 and 140 fathoms there is a layer of water of intermediate temperature, and as wave motion cannot reach so far down under a covering of ice, Admiral Makarof holds that, in order that the waters may be mixed, the surface of the Arctic must be open in summer over a large expanse, or that at some part the water is of so low a salinity that the layer, to preserve equilibrium, must be thin, and the warm water approach the surface.

From lat. 78° to the Pole the distance is 720 nautical miles, one-third of which is stated by authorities to be open water in summer. But if one-fourth be taken, that is, a distance of 180 miles, an ice-breaker with a speed of 12 knots would traverse it in fifteen hours. Again, one-fifth (say 144 miles) would be ice one year old, and in summer split up by canals and fissures. Through such ice an ice-breaker of 20,000 horse-power would steam 4 knots an hour, and therefore traverse the whole distance in thirty-six hours. The next section, 120 miles, of two-year-old ice would be steamed through in forty hours at the rate of 3 knots an hour. Proceeding in this way, and allowing for hummocks, Admiral Makarof reckons the total time required to reach the Pole from lat. 78° as 291 hours, and considers that he has taken the resistance as rather too high, and the velocity consequently too small.

Another, very practical, use to which ice-breakers may be applied is to keep up communication with the Ob and Yenisei. Hitherto vessels have been able to make their way through the Kara at most once a year when the ice conditions were favourable, whereas with an ice-breaker to open a passage the voyage might be made every fortnight from the time when the mouth of the Yenisei is free of ice, 1st to 15th June. The goods which Siberia can supply are too heavy to pay the cost of transport by railway for long distances, so that the sea traffic would not compete with the railways, but rather benefit them by increasing the wealth of the country.

Since Admiral Makarof delivered his lecture in 1897 he has consulted many experts in ice-navigation, and made special inquiries into local conditions. The entrance to the Ob is shallower than the mouth of the Yenisei, and not practicable for vessels drawing more than 14 feet of water; and therefore an ice-breaker of 10,000 horse-power, drawing 22 feet, could not enter. For this river, then, one of 5000 tons might be used, which would assist the other (pushing against its stern) in the ocean. The time of navigation must be fixed by the freezing of the Siberian rivers. The upstream steamer must leave the transhipment port on September

27th in order to reach Krasnoiarsk before the ice closes up the river, about 13th November, and the same date is the latest for rivers steamers to leave Dudinka, on the Ob. In spring the river is free at Krasnoiarsk about May 1st, and at Yeneseisk on May 7th, but as the mouth of the river is closed till June 24th, the 17th is the earliest date that river steamers need leave Krasnoiarsk.

Admiral Makarof's plan is to have two ice-breakers built, one of 10,000, the other of 5000 horse-power. The former is to keep open the channel to St. Petersburg as much as possible in winter, to conduct vessels through the White Sea to Archangel in the spring, and from June to ply to the Yenisei. The smaller one will be engaged in the traffic with Riga in the winter, accompany the larger one in summer through the Kara Sea and enter the Ob, while in autumn it will assist vessels to get out of Archangel into the sea, which does not freeze over until January.

Part of this project is now being carried out. An ice-breaker, the *Yermak*, of 8000 tons and 10,000 horse-power, has been built by Messrs. Armstrong, Whitworth and Co. It is divided by bulkheads into eight large compartments and forty-eight smaller ones. When the vessel was on the stocks these compartments were filled with water, a test which few ships could bear. Another special feature is the pump-room, where pumps capable of pumping 10 tons of water a minute can empty any individual compartment or transfer ballast water from one side of the vessel to the other. The *Yermak* has three screws at the stern and one at the bow. It has already proved of service in the Baltic. On its voyage from Newcastle it met with compact ice near Reval, which it broke at the rate of 7½ knots an hour; encountered, when in sight of Seskär, ice 9 to 10 feet thick (?), which reduced its speed to 2½ knots; and on March 23 it released three steamers and the Reval ice-breaker from a dangerous position.

MISCELLANEOUS.

Mr. H. J. Mackinder has left England in command of an expedition to thoroughly explore **Mount Kenia**.

In the middle of last month the **Duke of the Abruzzi** sailed from Norway for Franz Josef Land in the *Stella Polare*, a vessel designed for ice navigation.

The eleventh bulletin of the Instituto Geologico de **Mexico** contains a detailed list of the minerals in the republic and the mines, followed by a list arranged under the provinces, districts, etc.

We regret that the reference to the source from which the note on **Puerto Rico**, p. 265 (May), was extracted was omitted. The original article appeared in the March number of the *National Geographic Magazine*, and is from the pen of Professor Robert T. Hill, of the U.S. Geological Survey, who is also the author of *Cuba and Porto Rico*, reviewed on p. 271.

The **Nicaragua Canal** Commission recommends a route from Brito on the Pacific along the left bank of the Rio Grande, and then across the western watershed to the Rio Lajas. On the western side of Lake Nicaragua the river San Juan would be utilised as far as the Rio San Carlos, and then the canal would leave the river on the south and run to Greytown by the northern side of Lake Silico.

Through the influence of the Governor-General of Turkestan, the construction of a railway from **Tashkent** (75 miles) to **Chimkent** has been decreed. This is the first section of the line which will some time or other connect the Transcaspian

railway with the Siberian, running probably from Chimkent through Aulikata (Auliye-ata), Pishpek, Tokmak, Vernoie, Kopal, Serghiopol, and Semipalatinsk.—*Deutsche Rundschau*, Jahrg. xxi. Heft 8.

Herr Hans Leder of Jauernig started in April last for Central Asia. He will leave the railway at Irkutsk and travel by tarantass to Kiakhta and Urga. Herr Leder has visited Urga before, and, through his acquaintance with Tushetu Khan, the most influential of Mongol princes, assisted also by his knowledge of the language of the chief Mongolian tribe, the Khalkas, he hopes to reach **Lhasa** in disguise, accompanying a caravan of pilgrims.—*Deutsche Rundschau*, Jahrg. xxi. Heft 9.

Dr. Kashpar, director of the Russian Archæological Society, has discovered an ancient city about nine miles from Sebastopol. The streets and houses are well preserved, and hundreds of objects are unearthed daily, including statues of marble, bronze, and terra-cotta. The coins, which have been dug up in large quantities, date from the Christian Byzantine period. A Greek colony was established here about 550 B.C.; later on the town belonged to the Romans, passed into the hands of the Tatars, and finally became the property of Russia.—*Deutsche Rundschau*, Jahrg. xxi. Heft 8.

The staff of the **Oxford School of Geography** has been appointed. Andrew J. Herbertson, Ph.D., is assistant to the reader, Mr. Mackinder; H. N. Dickson, F.R.S.E., is the lecturer on Physical Geography; and G. B. Grundy, M.A., lecturer on Ancient Geography for 1899-90. The work of the school will include a course of systematic instruction intended for graduates and other advanced students, with demonstrations and practical work in physical geography, cartography, and surveying. Courses of lectures will also be given with special reference to the historical and scientific teaching in the University.

In the new edition of the chart of **Spitzbergen** considerable additions and emendations have been made, the interior of West Spitzbergen being drawn from the survey of Sir Martin Conway, and Wyche's islands from those of the expedition under Professor Nathorst. Several soundings taken on board Mr. Andrew Coats' yacht have been inserted. Hope Island is still marked "quite barren," and is inclined at too large an angle to the meridian; its height should also have been marked. The low flat island in Stor fiord is still retained, though it must have been seen from the *Princesse Alice* if it existed (see vol. xv. pp. 113-126). The chart should have been extended to include the whole of Wyche's islands, which now receive the name given to them by Edge.

M. Paul Serre, writing from San Francisco, has informed the Société de Géographie de Paris (*Comptes Rendus*, No. 3) that the sailing vessel *Cape Clear* made the passage from Hamburg last year in 152 days, round the Cape of Good Hope. The distance is 24,296 miles, and for nearly two consecutive months the vessel made 222 knots a day on an average. The distance from **Hamburg to San Francisco** round Cape Horn is a little over 14,000 miles, or some 10,000 miles less than by the Cape of Good Hope route. The time taken by a vessel sailing round Cape Horn is about 120 days in good weather, but in bad weather 150, and the risks of damage to the vessel and rigging are very considerable, so that the longer route may sometimes be the quickest. The calms in the Pacific are the chief drawback. A sailing vessel which left Tahiti three days after the ship that plies regularly between Papeete and San Francisco did not arrive at the latter port till ten days later, the captain not knowing the exact route where the winds are favourable

NEW BOOKS.

Roxburgh, Selkirk, and Peebles. By Sir George Douglas, Bart., M.A. Edinburgh: William Blackwood and Sons, 1899. Pp. xvii + 482. *Price* 7*s.* 6*d. net.*

The verdict concerning this book depends upon the definition of the term County History. If it ought to be a volume wherein one might be sure to find the detailed history of each particular place and important family within the shire, this effort falls short of success. But if a county history ought to be a concentrated essence of such details, Sir George's work compels admiration. The true dictum is that detail ought to be in inverse ratio to the importance and dimensions of the subject. Obviously the county must have more detail in its history than the country, the parish than the county, and the family than the parish. Whatever his convictions on this point, Sir George Douglas was effectively precluded from choice by having to deal with three counties in one volume, and this is perhaps not greatly to be regretted, each county having already had its chronicles recorded with more or less minuteness by Jeffrey, Craig-Brown, and Chambers. To a great extent Sir George's aim has been to "Liebig" these into an extract which, while it lessened the volume, should retain all that was nutritious; and he has added a literary flavour which makes it distinctly more palatable to the general reader. It was a difficult task, requiring not only work and patience, but, in a writer of Sir George's bent, a large measure of self-restraint. He is more at home on Pegasus than on the ordinary cob; and when he comes upon ballad and legend he is constantly tempted to exchange the steady-pacing for the more flighty steed. The way he pulls himself up every now and then with some sobering reminder addressed to himself is almost pathetic. Now that he has done his duty by the sordid facts, let him give free rein to his fancy in dealing with the folklore and the poetry of the three counties. Then should we have a book worth waiting for.

Wisely spending little time over the nebulous period before Caesar's invasion of these islands, Sir George emphasises the probable influence of the Roman occupation of southern Scotland—an influence seldom realised to its full extent either by national or local chroniclers. It is difficult to sympathise with Sir George's hesitation in identifying the Roman town at the base of triple Eildon as Trimontium; and in the same way, he might well have been more explicit in declaring an opinion about the Catrail—now admitted by all responsible antiquaries to be a roadway *et præterea nihil.* One of the finest features of this history is its author's review of the Monastic period, and of the benign influence exercised by the monks of Kelso, Melrose, and Jedburgh. But why refrain from stigmatising the miracles recorded of Cuthbert and Drithelm for what they are—deliberate fictions? If Bede declared he had Drithelm's *Purgatorio* direct from the lips of one to whom Drithelm had narrated it, so much the worse for Bede's reputation for veracity. It will not do to characterise Drithelm's narrative of his visit to hell as something akin to the dreams of Dante and Bunyan. These were avowed parables, whereas the miracles of the two primitive saints were meant to be believed, and resulted, as they may have been meant to result, in their tombs and relics becoming lucrative objects of superstition.

It would be interesting to consider Sir George's ideas in regard to the ethnology and philology of the Border counties; but space will not allow us to do more than suggest that he seems to rely too much on Professor Veitch, whose enthusiasm (beautiful in itself) was sometimes in advance of his accuracy.

For such pictures as the veracious historian is warranted in drawing of Wallace

as he stalks through the Borderland; of kings, nobles, and chieftains; of peels, freebooters, and border warfare; of bloody battlefields and bloodier reprisals; of prelatic persecution and Presbyterian restiveness, we refer our readers to the book itself, with the assurance that they will find in its perusal much pleasure and instruction, sweetened by a charming style which is its author's own.

In maps, bibliography, and index the book excels; and it is prefaced with a graceful and well-merited dedication to Lord Lothian for his assiduous care of Jedburgh Abbey.

History of Egypt under the Ptolemaic Dynasty. By J. P. Mahaffy. London: Methuen and Co., 1899. Pp. xiii + 261. *Price* 6*s.*

This volume is the fourth in a series of six books on Egyptian history, of which all but the last, which is to treat of Arabic Egypt, have already appeared. Professor Mahaffy is fortunate in the section of the work which has fallen to his pen, as it is the one which most abounds with details in which all can take a lively interest. The history of the ancient dynasties in the first three volumes affords but dry reading. The kings who there pass in long succession before us have left traces so dim of their personal attributes and inner life that they resemble more the spectral figures in the procession of Banquo's descendants than creatures of flesh and blood. The details, again, which make up the account of the Roman period are not of a nature calculated to contribute much to the entertainment of the ordinary reader. Very different, however, is the case with the period under notice. The Ptolemies who then ruled Egypt are known to us in the plenitude of their lives, characters, and achievements, not merely from panegyrics inscribed on their monuments, but from the pages of authentic and contemporary history, and from the verse of the poet. Add to this that the founder of the dynasty was a great soldier and still greater statesman, who had fought for years by the side of Alexander, and stood high in his favour; that his successors were the most munificent patrons of literature, art, and science in all antiquity; and that the last representative of the line was the fair and all-fascinating Cleopatra. With these and suchlike materials to work upon, the practised pen of Professor Mahaffy could not but produce a narrative full of charm and absorbing interest. But this is far from being the sole merit of the volume before us. The author is thoroughly at home in his subject, having long and carefully examined all the sources of information regarding it, and having besides a personal knowledge of the scenes of the transactions which he records. In 1895 he published a work similar to the present entitled *The Empire of the Ptolemies*, and in the preface thereto warned his readers that in his subject, which was constantly growing by reason of frequent new discoveries, finality was not to be expected. Since these words were written fresh inscriptions have been discovered, which have served to fill up occasional blanks in the Ptolemaic annals or to correct accepted errors. Many papyri besides, whether formerly or more recently discovered, have been deciphered, and though they mostly refer to later times than the Ptolemaic, still there are some of earlier date which have proved useful in throwing light on the internal administration of the country, and on the political and social condition of the Egyptian population—subjects which historians almost entirely ignored. They show that though the people were very heavily taxed, and the taxes rigorously collected to support the pomp and extravagance of the court, yet that justice was fairly well administered, and better than in the other countries ruled by Alexander's successors. We find, accordingly, that attempts at rebellion, though not unknown, were of rare occurrence under the earlier Ptolemies. They became more frequent under the later

monarchs, in consequence of the oppression of the tax-farmers and the bad conduct of officials, to which the downfall of the dynasty was to a great extent due. These documents show further to what extent the Greek conquerors of Egypt became in the course of time amalgamated with the native race, and that mixed descent did not bar the way to high official appointments. Several of the Ptolemies, especially the earlier, were men of shining capacity in the art of government, and Egypt under their sway reached its culminating point of power and prosperity. For a considerable length of time they controlled the Mediterranean with their fleets, and exercised a predominant influence in the affairs of the world at large. Their policy towards the Egyptian people presents a favourable contrast to that pursued by the Persian rulers who preceded them. Instead of offending their religious prejudices they were careful to respect them, and sought to ingratiate themselves with the multitude by cultivating the friendship of the priests, and by building and endowing temples for native worship. They even adopted, in imitation of the example of the kings of the old dynasties, a practice as utterly abhorrent to the Greek mind as to our own—that of the marriage of brothers and sisters as a means of securing for the throne the purity of the blood-royal. They claimed also for themselves, like the kings referred to and like Alexander the Great, the honour of deification with temples and ritual observances. In an appendix the throne titles of the members of the dynasty are explained. The volume is copiously illustrated, and contains a map of ancient Alexandria.

Among the Wild Ngoni. Being some Chapters in the History of the Livingstonia Mission in British Central Africa. By W. A. Elmslie, M.B., C.M., F.R.G.S. Edinburgh and London: Oliphant, Anderson, and Ferrier, 1899. Pp. 320. *Price 3s. 6d.*

Dr. Elmslie of the Livingstonia Mission here gives a plainly written but very interesting account of the Ngoni Zulus of British Central Africa. Perhaps the most interesting part of the book to the ordinary reader is the first chapter, which deals with the history of the tribe, and describes how they came to break away from the parent Zulus in the neighbourhood of Natal, and to form independent clans many hundreds of miles farther north. Fighting and bloodshed marked their track. After much wandering they arrived at the country to the south of Tanganyika, where again there were subdivisions, a part of the tribe—the Magwangwara—going to the east of Nyassa, and the remainder scattering themselves over the country to the west of the lake, under several chiefs. Some of the Ngoni still tell of an eclipse of the sun which occurred when they were crossing the Zambesi, an event from which the time and place of their crossing might be fixed.

In their new country the Ngoni kept up their reputation as a fighting race, and raided all the surrounding tribes—the Magwangwara raiding on the east side of Nyassa down as far as Lake Shirwa, where they were checked by Kawinga's Yaos, and Chikusi's Ngoni on the west raiding even into the Shire Highlands, against the Mngoche Yaos there, with partial success. The cessation of these plundering expeditions is entirely due to mission influence and to the presence of white men among the natives.

The rest of the book deals with the people and their customs, and with the work of the Livingstonia missionaries and their effect upon the Ngoni, and, clearly and simply told as it is, should prove highly interesting to those who study folklore among primitive races. Although written from a mission point of

view, and intended mainly to record the history of the mission among this tribe, the book is a readable one on all sides, and may be taken as a fair and unbiassed account of the matters with which it deals. We think, however, that it deserves a less "cheap" title.

From Peking to Petersburg. By Arnot Reid. London: Edward Arnold, 1899. Pp. 293. *Price* 7*s.* 6*d.*

In this book, which disclaims being a story either of adventure or exploration, we have a pleasantly written account of a journey from Peking to St. Petersburg, with a great many hints very useful to any one who is thinking of making such a trip. Probably the most sensible of all these hints is when the author, who is an experienced hand, advises all travellers to take as few things as possible with them to the Chinese ports or to Peking, because when they get an outfit at home they are nearly sure to include in it a number of superfluous and useless articles, whereas they can get everything that is necessary at a fairly cheap price when they land, and so they will avoid much trouble and cost of freight. According to Mr. Reid there is now neither difficulty nor danger in the journey across China and Russia, and there is not much expense. Like others who have travelled in Siberia, he is enthusiastic in his appreciation of Russian kindness and hospitality, the latter of which, when it takes the form of expecting one to drink mixed wines and liqueurs for some hours at a stretch, must often be rather trying. We have a good description of the Trans-Siberian railway so far as it has been laid down, and of the way in which it is being hurried on at the rate of four miles a day. Mr. Reid anticipates a great future for Siberia, which he thinks is quite capable of sustaining a population of fifty millions and of exporting much wheat, gold, etc., as well. He also describes the facilities the Russian Government gives to its own emigrants.

Regardless of the susceptibilities and feelings of Messrs. Labouchere and Morley, Mr. Reid sets forth his own plan of dealing with the Far East problem, and it is calculated to open the eyes of both East and West. His first solution is the simple one that England and the United States should guarantee the integrity of China and undertake the control of its government. Foreseeing that the United States, after its experience of Cuba and the Philippines, may not be keen to undertake to govern China, his next plan is that England and Russia should agree to practically partition China between themselves. To this plan there is the obvious objection that it may entail a war with England and Russia on the one side and the rest of the world on the other. So Mr. Reid has a third solution, viz., that in default of the two plans above mentioned England should enter tooth and nail into the game of grab. If his views are right, the prospects of China in the future are much worse than most people believe.

Nouveau Dictionnaire de Géographie Universelle. Ouvrage commencé par M. Vivien de Saint-Martin, et continué par Louis Rousselet. Supplément, A—C. Paris: Librairie Hachette et Cie., 1895-97. *Price* 20 *frcs.*

The first volume of M. de Saint-Martin's work was published in 1879, and therefore it is not surprising that the supplement is nearly as large as the original volume. In this part of the dictionary is included Africa, as well as many of its subdivisions—German East Africa, British East Africa, Algiers, Angola, etc., where many new geographical features have been discovered since 1874 (the date of the article in the original work), and much progress made towards opening up

the country. M. Rousselet gives a summary of exploration from 1873 to 1895, which is very good on the whole, but he does not mention Thomson's journey to Sokoto in 1885, nor, though he mentions Teleki and Von Höhnel, does he record their most important discovery, the lakes Rudolf and Stefanie. The bibliography is full, though here we miss Thomson's *Travels in the Atlas and Southern Morocco*, and one or two other important works.

China is also the subject of a long article, as well as Bhotan and Korea, of which latter country much fresh information has been obtained during the recent disturbances. In fact, a large proportion of the names in the original gazetteer appear again in the supplement, as there is new statistical matter to be added in countries where exploration has long ceased. Great care has evidently been taken in collecting all the latest data, and in consequence the work is of great value for reference. Names of little-known rivers, mountains, etc., are not always to be found, or only in the hydrography of the country in which they are situated; but perhaps it is not the intention of the author that the work should serve the purpose of an ordinary gazetteer.

There are a few misprints, English names suffering most; it is only surprising that there are not more in such a large collection of names of the most varied origin.

The Development of Cyprus and Rambles in the Island. By Colonel Fyler, late of the 50th Regiment. With Coloured Illustrations, Maps, and Plans. London: Percy Lund, Humphries, and Co., Ltd., n.d. Pp. 187.

Despite the utmost disposition to welcome any book which seeks to interest either the eastern tourist or the colonial statesman in this too-long-forgotten region of the empire, it is impossible to avoid expressing disappointment over Colonel Fyler's book, and this chapter by chapter.

Its historical section might be forgiven, though of little interest; but the chapters on "Political and Financial Position," and "Commercial Position," though containing of course some facts and figures which may be of use in awakening interest among those quite new to the subject, do not indicate any really thorough study or any adequate economic grasp of the situation. The chapter on "Military and Naval Position" is essentially a plea for the improvement and fortification of Famagusta Harbour, with reproduction of plan and summary of a report obtained by Government soon after the occupation of '78. In fact, the whole book gives the impression of being a *réchauffé* of impressions about that period, very imperfectly brought up to date by reference to a few reports and blue-books, or by desultory conversation with ex-officials, themselves imperfectly informed.

Even the merely tourist portion of the book has been much better done in many previous books, not one of which, however, seems to be known to the writer. The map is poorly executed, but one or two of the water colours, although amateurish in execution, give a fair idea of local contour and colour. The printing of the book, and its get-up generally, are second-rate: several of the process blocks are good, especially those of cathedrals, etc., reprinted from Mr. Walters' article in a recent number of the *Architectural Review*. But of the many books on Cyprus, this is as yet on the whole the very slightest.

Voyage au Pays des Mines d'or. Le Klondike. Par Raymond Auzias-Turenne. Paris: Calmann Lévy, 1899. *Price* 4 *Frcs.*

If there are any of our readers who prefer to have a graphic and pleasantly written account of Klondike in French rather than in English, we can recommend

to their notice this work of Monsieur Auzias-Turenne. There is little in it that is not now easily accessible in English shape, unless it be the details regarding individual claims, which can be of interest only to a limited circle of readers. The writer seems most anxious to expose the difficulties and hardships of the life led by miners and explorers on the Yukon and its tributaries, and his descriptions of what he has seen and heard are gruesome and sometimes repulsive, although we have no reason to suspect that they are exaggerated or untrue. He corroborates in vivid and emphatic language what we have already heard from Mr. Ogilvie and Mr. de Windt. Life in Klondike is a lottery with some magnificent prizes, but they can be gained only by prolonged exertion and sustained hardships, such as break down and destroy all but the most determined and hardy of men.

History of Scotland. Vol. I.—To the Accession of Mary Stewart. By P. Hume Brown, M.A., LL.D. ("Cambridge Historical Series.") Cambridge: At the University Press, 1899. Pp. 408. *Price* 6*s.*

A book on Scottish history written by Dr. Hume Brown is sure to attract attention. For the present we merely announce the publication of the first volume, reserving further remarks till the concluding volume appears.

Ocean Rainfall by Rain-Gauge Observations at Sea. By W. G. Black, F.R.M.S. Edinburgh: E. and S. Livingstone, N.D.

In these pages are collected a number of observations at sea with rain-gauges, provided in many cases, we believe, by the author. They are arranged in tables and curves for each ocean, and are preceded by explanatory text. This material was made use of by Dr. Supan for his map of ocean rainfall, published in *Petermanns Mitteilungen* (see *S.G.M.*, vol. xix. p. 662).

Svenska Turistföreningens Årsskrift för År 1899. Stockholm: Wahlström och Widstrand. Pp. 443. *Price* 4 *kr.*

The Swedish Tourist Club does much to make the beauties of its country more generally known. The latest annual is larger than the last we noticed, and is adorned with many good illustrations. The articles describe travels in Ångermanland, Jämtland, Skåne, etc., and one treats of a journey across the peninsula from Skefteleå to Bodö. There are still large tracts of beautiful country in Sweden which have hardly been seen by the foreign tourist.

Norway, Sweden, and Denmark. Handbook for Travellers by Karl Baedeker. Seventh edition. Leipzic: Karl Baedeker, 1899. Pp. lxxx + 463. *Price M.* 10.

Four years having passed since the last edition was published, several changes in means of transport have to be recorded. Several new maps (including one of Northern Sweden) and plans have also been added, and the Spitzbergen tour is described.

Year-Book of the Scientific and Learned Societies of Great Britain and Ireland. Sixteenth Annual Issue. London: Charles Griffin and Co., 1899. Pp. 287. *Price* 7*s.* 6*d.*

The volume is of the same character as the preceding ones. The list of Societies seems to be very full, but the new geographical society at Southampton is not included—perhaps because it is not yet in thorough working order.

NEW MAPS.

WORLD.

MEERESSTRÖMUNGEN, Weltkarte zur Uebersicht der ——. Entworfen und bearbeitet von Dr. Gerhard Schott. 1898. 3 sheets.
Deutsche Seewarte, Hamburg.

These sheets, compiled by a well-known oceanographer, show the currents prevailing on the whole during the winter of the Northern Hemisphere. The warm and cold currents are better defined than in the atlases previously issued by the Deutsche Seewarte. Inset maps show the currents in the neighbourhood of the Equator during the northern summer.

EUROPE.

ENGLAND. The "Bath Road" Map. The "Southampton and New Forest Road" Map. Compiled by Harry R. G. Inglis.
Gall and Inglis, London and Edinburgh.

The first of these maps has been noticed before in this Magazine. The most striking improvement is the addition of a strip showing the vertical profile of the road. A few other modifications have also been introduced.

AMERICA.

BRITISH COLUMBIA. Shushwap Sheet, geologically coloured. Do., Economic Minerals and Glacial Striæ. By George M. Dawson, C.M.G., LL.D., F.R.S., assisted by James M'Evoy, B.A.Sc. Scale 1 : 253,440, or 4 miles to an inch.
The Geological Survey of Canada.

ONTARIO, Map of North-Western ——, showing existing surveys. 1897. Scale 4 mile to an inch. 4 sheets.

LAKE HURON, Map of the North Shore of ——. 1897. Scale 6 miles to an inch.

NIPISSING, Map of the Northern Part of the District of ——, in the Province of Ontario. 1898. Scale 4 miles to an inch.

ALGONQUIN NATIONAL PARK of Ontario. N.D. Scale 1½ miles to an inch.
Presented by Dr. Robert Bell, of the Geological Survey of Canada.

AUSTRALIA.

AUSTRALIA, Reduced Survey Map of ——. By J. G. Bartholomew, F.R.G.S. 1899. Scale 1 : 6,000,000. *The Geographical Institute, Edinburgh.*

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

PHYSICAL GEOGRAPHY OF NORTHERN CENTRAL AMERICA.

Central America and the West Indies are among the regions of the globe whose physical geography are not at all well known from a scientific point of view. The new *Ergänzungsheft* of *Petermanns Mitteilungen* (No. 127) contains an account of the land-forms and surface features of the northern part of Central America by the well-known authority, Dr. Carl Sapper of Guatemala.

The original mountains cover a considerable area, and, according to Dr. Sapper, are a continuation of the Archæan arc of the eastern Sierra Madre of Mexico. Crystalline schists are found particularly in Guatemala and at Honduras, but are wanting in Salvador, mica-schist being the most common, and then phyllite and gneiss. These rocks are very much disturbed and are greatly faulted, but, on the whole, the east and west strike predominates. The Palæozoic rocks appear to be of Carboniferous age, and are confined to the east of Chiapas, Middle Guatemala, and British Honduras, south of which they are completely wanting. Here the north-west strike predominates; but in British Honduras here and there a north-east, and sometimes almost a northerly, direction is observed. Mesozoic rocks are found in Guatemala, Chiapas, and Honduras, but they are lacking in Yucatan, and few are found in British Honduras or Salvador. Most of them are of Cretaceous age, and Cretaceous limestone forms the northern half of the mountain range of Chiapas and Central Guatemala.

Tertiary rocks predominate in Yucatan and Petén (North Guatemala) and in the north of British Honduras, but in south Guatemala and San Salvador they are of very limited extent.

The Miocene and Pliocene limestones of the north of Central America have been deposited since the mountains of Chiapas, Guatemala.

and British Honduras were formed, and have suffered scarcely any disturbance.

Quaternary rocks are found along the river courses and along the coasts, more particularly round the Gulf of Campêche.

The west coast of Yucatan contains no igneous rocks.

Granite is the chief rock in the Sierra Madre of Chiapas, and serpentine is common farther east.

The south of Guatemala and Salvador is almost entirely composed of young volcanic rocks.

Tectonic.

The mountains of the north of Central America are both asymmetrical and varied in their structure. Leaving out of account the southern flanks of the original upheaval, of which only unimportant remains are left, we find, north of the azoic mountains, which are complicated and much disturbed, a Palæozoic fold mountain in which faults, and longitudinal faults especially, have destroyed the original disposition. North of this again is a band of crystalline schists, parts of which still remain in the north-east of the Sierra Madre of Chiapas. Now, however, the Palæozoic mountains of Chiapas and Guatemala are cut short in the north by gigantic and longitudinal faults with frequent bends, and beyond there is a considerable Mesozoic and old Tertiary region. In Chiapas these Mesozoic and old Tertiary strata are fairly flat, although steep folds are not wanting, but through many faults they are made into a fracture land that reveals itself in orographical contours. In the chains of Central Guatemala the energy of the folding of the Mesozoic and old Tertiary region has been much greater and predominates for long distances, and in Alta Verapaz the mountains fall in step-faults to the lowlands of Petén. While in the highlands of Chiapas recent volcanic rocks have poured out in large volumes from numerous fissures covering extensive areas, and in many places have given rise to ranges between the various fault mountains, such recent outbreaks have never taken place in the Mesozoic part of the ranges of Central Guatemala. While in Guatemala and Chiapas Mesozoic and Tertiary regions succeed the Palæozoic and Archæan mountains, in British Honduras an Archæan horst is found, which is known as the Cockscomb Mountain. This is the remains of an old range, which formerly must have run more or less parallel to the chains of Guatemala and Honduras. In this connection it is important to notice the submarine ridge of the Misteriosa bank and the Cayman banks running from British Honduras towards southern Cuba and the south-west peninsula of Haïti, and a similar one extending from Honduras over the Rosalind and Pedro Banks, Jamaica and Navasa, towards the south-west peninsula of Haïti. It is natural to assume that these are the continuations of the two almost parallel mountain ranges of northern Central America, but too little is known of the geological formation of the islands, with the exception of Jamaica, to allow of certainty in the matter.

The highlands of northern Central America have passed through

three principal phases of construction and modification. The first epoch of formation was towards the end of Archæan times. The second epoch, of folding and faulting, occurred in Carboniferous times, and was associated with great intrusions of granite. The third epoch, of faulting and folding, occurred in Miocene times, and gave the present physical appearance to the country. Late igneous rocks flowed out from innumerable fissures, and have covered the older rocks on the southern slopes of the mountains. Before this third epoch of mountain building, however, considerable eruptive material (serpentine and diorite) issued from longitudinal clefts in Mesozoic times. Since the third epoch considerable changes of level have taken place. In Chiapas from 2200 to 2400 m. (7200 to 7500 feet) of Tertiary deposits with lamellibranchs have been found lying almost horizontally, but the exact age cannot be determined from the fossils still remaining.

Volcanoes arose over the whole of the southern flank of the highlands towards the end of Tertiary times, several from fissures running east-south-east. The more recent strata of Yucatan, Petén, and northern British Honduras were laid down after the formation of the mountain ranges of Central America, and therefore did not share in the disturbances of the latter, but in some places they are bent into very slight folds. The east coast of Yucatan is not so straight as is usually supposed, and it seems that it has sunk in very recent geological times, and in many places shallow inlets have penetrated into the interior of the land, producing a more varied coast-line, and through the same sinking the north and west of Yucatan have been submerged where the Yucatan bank now lies. The sinking was even more considerable in diluvial times than at present. The chief mountains of northern Central America have a curved form, and the remains of the original upheaval and of the Palæozoic mountains show traces of the same arrangement.

The greatest continuous remnant of primitive mountains is the Sierra de las Minas, with the Sierra de Chuacus on the one side and the Sierra del Mico on the other. Fragments of a parallel chain of primitive rocks lie to the south in the provinces of Guatemala, Jalapa, Chiquimula, to the east in the sierras of La Grita, Espiritu, and Omoa, and probably occur beyond, along the north coast of Honduras. A third parallel range may be traced in the northern Sierra de Madre of Chiapas, in Alta Verapaz; while the crystalline schists of the Cockscomb mountains probably formed part of a fourth. To the south and west the crystalline schists disappear under eruptive rocks. From the Palæozoic rocks they are separated by faults along which eruptive rocks have often poured forth, as, for instance, the belt of serpentine which skirts the southern flank of the Sierra de las Minas for about 140 miles.

The Palæozoic rocks in Guatemala and Chiapas are confined chiefly to two ranges, of which the southern only attains an important development on the boundary of Chiapas and the southern part of Alta Verapaz. These chains owe their origin to folding, and exhibit a great number of faults, and on their southern boundary are pierced by many intrusive dykes of serpentine, trachyte, quartz-porphyry, and granite. The variety of eruptive rocks is an indication that faulting and fissuring took place at

very different epochs; but it is noteworthy that the faults always occur in sedimentary rocks, which here exhibit less cohesion than the older fissures cemented together by eruptive rocks. In the Cuilco valley and in Verapaz the Palæozoic rocks abut immediately on the crystalline schists, while in Lower Verapaz intrusions of granite and serpentine separate the two series.

Carboniferous limestone generally constitutes the upper parts of the Palæozoic mountains, while the clay and sandy rocks are confined to the valleys, reaching considerable heights only in Chiapas. The horst of the Cockscomb mountains consists principally of Palæozoic argillaceous rocks and sandstones, while the limestone covers a very small area. The range is broad but very short, but the Palæozoic strata probably extend to the neighbourhood of Dolores in Petén. Their strike is about east and west, though not without exceptions. The dip is often slight, generally moderate, and seldom very steep. In the main the Cockscomb is a folded range: the observations made up to the present do not allow its structure to be thoroughly described.

The Mesozoic and Tertiary elevations of Chiapas and Middle Guatemala, against which the Palæozoic mountains break off with a great longitudinal fault, exhibit different characters in the two countries. In Chiapas the strata are bedded nearly horizontally over large areas, so that faulting and subsidence have contributed more than folding to the peculiar character of the country. But from Tenosique to S. Cristobal the number of independent blocks becomes greater, and at the same time folding plays a more important part. The strike of the faults is in general about west to west-north-west. Many valleys in Chiapas are in parts due to faults, often longitudinal, sometimes transverse or oblique.

From the central table-land of Chiapas the Cretaceous limestone descends in a flexure to the broad hollow through which the Chiapas river flows. In this hollow the strata have only a slight dip, the limestone in consequence of denudation rising above the Todos Santos strata (sandstones, etc. without fossils, of undetermined age). To the south-east a fault divides them from the Archæan and Palæozoic mountains, while to the south-west rises the granitic coast range. Eastward towers up the huge wall of the Altos Cuchumatanes, parted from the hollow by a transverse fault.

Alta Verapaz is a folded mountain mass divided in its northern part by numerous faults, and hence sinking in terraces to the lowlands of the Petén. The subsidence of the south Petén basin has not only produced the step-faults and the comparatively small breadth of the Mesozoic-Tertiary mountains of Verapaz, but has cut crosswise the Mesozoic ranges of Chiapas, and probably considerably curtailed the original length of the horst of the Cockscomb mountains.

A similar subsidence basin of far greater extent is the Gulf of Mexico, while the mountain ranges of northern Central America are in general cut off eastwards by a transverse fault running nearly parallel to the later fault which bounds the mainland towards the Caribbean Sea, and is marked by the coast-line of Yucatan and its prolongation

in the series of islands off British Honduras. In the south, faults and subsidence have taken a principal part, but their course is not easily determined, being concealed by outflows of eruptive rocks.

A great fault running north-westwards has cut short the Palæozoic and Archæan chains in south Guatemala and Chiapas, and their former prolongation has sunk down. Through the fissure have been thrust upwards the immense granite masses which now form the Sierra Madre of Chiapas. In southern Guatemala this range is almost completely covered by late eruptive rocks. On this main fissure another marked by granitic intrusions abuts at the Mexican frontier, marking the limit between the Archæan and Palæozoic formations.

Most of the later eruptive rocks have issued from a slightly curved main fissure beginning in south-eastern Chiapas and passing through south Guatemala to Honduras, and from a parallel line of weakness running from the Cerro de la Gavia through Salvador to the Pacific coast. Between these a smaller eruptive range extends past Azacualpa and Chingo to San Salvador.

The course of the Pacific coast of Salvador, Guatemala, and Chiapas, the original trend of the Tabasco coast, as well as of many stretches of coast on the Caribbean Sea, do not depend directly on the lie of the individual faults and fissures, but only indirectly, as the coastal plain is built of alluvial (on the Pacific side also volcanic) material that has come from the neighbouring mountains and volcanoes. The coastal plains are therefore a consequence of the degradation of the neighbouring mountains and a result of the volcanic outflows, and accordingly depend on the importance of these mountains (and volcanoes), as well as on the extension of the streams. The deep incurving of the sea in a number of bays in the Mexican Gulf and the Caribbean Sea is, however, the consequence of a sinking of the land; and on the Guatemala coast this sinking appears to have continued to the most recent times. (*Erg.-Heft* 113, p. 19 f.) At present the conditions seem to be stationary, —at any rate earthquakes over a considerable area in northern Central America are comparatively seldom and of little significance.

Orography.

Yucatan and the northern part of Petén and British Honduras are table-lands in which folds and faults are of little importance. The foundation of the mountain land of north and middle Chiapas is a fractured table-land in which the strata in some blocks are still horizontal, while in other dislocated blocks they are steeply tilted. Folding and flexure play no great part here. The Altos Cuchumatanes as well as the Palæozoic and Archæan mountains are fold mountains in which nevertheless faulting plays an important role. Alta Verapaz is a fold mountain bounded by step-faults. The granite Sierra Madre of Chiapas and the young volcanic cordilleras of south Guatemala are broad ridges. Of plains of deposition there are those of Tabasco and the Pacific coast, the alluvial river plains, and the small flats found in the hollows of the mountains.

Yucatan is a fairly flat karst-like land, which has become attached to Central America in comparatively recent times. It has true plains of only insignificant extent, and is covered with hills and flat subsidence basins. In the north, down to about the parallel of Ticul, the land is flat; then it rises into undulations, the cones of denudation reach greater heights and have steeper slopes, and the hollows sink to greater depths. Near Bolonchenticul the elevation is fully 460 feet. In the south of the peninsula is a plateau, with an average height of 1300 feet, which falls in terraces to the east. This may be called the central tableland of Yucatan.

The State of Tabasco consists of a recent alluvial plain, intersected by numerous rivers.

Chiapas has three orographical zones: the mountains of northern Chiapas, the broad depression of Middle Chiapas, and the Sierra Madre in the south.

The mountains of northern Chiapas rise in steps from the plain of Tabasco, and form a somewhat complicated elevation with numerous longitudinal and cross valleys, obliquely debouching troughs, and a few eruptive ridges. The flatness of the higher parts and the lack of ridges with steep flanks on both sides is characteristic.

The highest point is the Hueitepec mountain, 9058 feet. The middle Chiapas depression falls gradually to the NNW. For the rest the country here is fairly flat.

The Sierra Madre consists in the west of a granite ridge, from which spurs run northwards, enclosing small plateaus. The highest points of this granite ridge cannot much exceed 8200 feet. But the eastern part of the range is loftier. It consists in the south partly of granite, partly of eruptive rocks, while its northern section is a Palæozoic range with remains of an Archæan chain. In both parts it attains heights of over 9800 feet.

Petén belongs in the north both orographically and geologically to the Yucatan peninsula. It is all studded over with cones of denudation. The southern part is a subsidence area, covered with Tertiary deposits, and fairly flat.

The mountain ranges of Middle Guatemala adjoin this low country on the south, and are bounded on the other side by the deeply excavated valley of the Motagua river and the Salegua and Cuilco valleys. This mountain region is made up of several dissimilar parts, a southern range chiefly composed of mica-schists, and another in the north principally of limestone and dolomite, clay-slates, sandstone and marl, which is divided into two halves by the narrow transverse valley of the Chixoy river, while the Altos Cuchumatanes lie in the west, and the highlands of Alta Verapaz on the east. The Altos Cuchumatanes are only known in their south and west parts. In the department of Huehuetenango the Mesozoic strata form a folded elevation which, probably in consequence of a transverse fracture, falls suddenly to the west; this part of the mountain reaches heights of 12,500 feet, and at the boundary towards the Palæozoic rocks contains the small narrow plateaus of Chancol and Rosario at elevations of 10,200 to 10,500 feet. The Palæozoic moun-

tains are disposed in two ranges, of which the northern, broken by the cross valleys of the Salegua and Cuilco, culminates north of Chiantla at 11,500 feet. The southern range is clearly defined only at its eastern and western extremities; it reaches its maximum elevation of 11,460 feet between the same rivers.

In Verapaz the southern Palæozoic range is enclosed between the valleys of the Polochic and Coban rivers on the one side, and the Panima and Carchela on the other. It rises to a maximum height of about 7500 feet. The northern range culminates in the Xucaneb (8360 feet), and splits near Tyalihux into two chains, one running eastward through Senahu and Mayucoua, the other more north-eastward. The Mesozoic and Tertiary mountains of Verapaz reach 6500 feet in the Chita, near Samac. Another range of some importance is that of Chinaja, beyond which begins the lowlands of Petén.

In southern Guatemala old mountain formations are of importance only in the east, rising in a considerable range from Zacapa eastwards to the Sierra de la Grita and appearing occasionally to the west in the department of Guatemala. Eruptive rocks forming dome-shaped summits and long ridges predominate. Loose volcanic ejectamenta have filled up many of the hollows and formed the plateaus of Guatemala. As this ground is easily eroded, the water-courses are found in narrow troughs, with steep, and in some places perpendicular, walls. The porosity of the volcanic soil is such that the vegetation is poor, and therefore there is little resistance to erosion. The same volcanic formation extends into Salvador and southern Honduras. There are many conifers and oaks, but on the whole the vegetation is poor here also, and the region has a marked dry season.

Many volcanoes rise above the southern slopes of the chief range of the eruptive cordilleras of south Guatemala and the coastal cordillera of Salvador. They retain a well-marked cone shape with radial hollows. Rarely has erosion proceeded far enough to open up the crater by a deep valley. On the southern foot of the recent eruptive mountains is the Pacific coastal plain.

In the Republic of Salvador the orographical conditions are simple. The coastal cordillera, from whose ridge the majority of the Salvador volcanoes rise, succeeds the small coastal plain, and farther north a young eruptive ridge stretches inland from Chingo, rising to 5400 feet in Cerro Cacaguatique. The river Lempa cuts across both mountain ranges and divides Salvador into two halves.

In the western part of Honduras there are three orographical zones: a southern late eruptive mountain; the mesozoic mountains, partly covered and broken through by porphyritic eruption; and lastly, in the north, an ancient mountain range, the Sierras de la Grita, del Espiritu Santo and de Omoa, rising to about 6500 feet.

In British Honduras there are also three orographical zones: lowland in the north, then the Palæozoic Cockscomb mountains, and in the south hilly country, chiefly Tertiary, that forms a connection between the Cockscomb mountains and the ranges of Central Guatemala. The northern lowland rarely passes 500 feet; the southern highlands reach

nearly 2000 feet. The Victoria Peak in the Cockscomb mountains rises to 3700 feet. The northern chief rise is granite, the rest of the mountain-land principally clay and slates eroded into deep valleys, but the thick vegetation has preserved the crusts.

Hydrography of Central America.

One-third of Northern Central America has inland drainage, most of the area lying in the Yucatan peninsula, but some also in Petén, in Salvador, in Chiapas and southern and central Guatemala. A half of the drainage is to the Atlantic, and one-sixth to the Pacific. The Pacific rivers are numerous, but short and of little consequence, and mainly flow in transverse valleys, the principal longitudinal valley being the middle course of the Rio Lempa, which is the most important Pacific river, 180 miles long, with a drainage basin of 7340 square miles. Few of the Atlantic rivers flow entirely in longitudinal valleys, except the Motagua, the Polochic (to the Ysabel Lake), and the Sarstoon; most other rivers flow partly in longitudinal, partly in transverse valleys, generally narrow and deep, and sometimes underground. Simple fold valleys have not been observed, but many rivers follow for long stretches the old fault lines—for instance the Polochic, the Panima, and part of the Motagua, etc.; or the fault determines the direction as in the Sacramento valley, and in some cases the trough-faults have done this (the Sabinalla valley in Chiapas). The ancient mountains of central Guatemala are not crossed by any river, but on the other hand the Usumacinta, the Chixoy, and also the Grijalva, cross the whole of the Palæozoic and Mesozoic mountains. The causes of this cannot yet be determined.

The longest Atlantic rivers flow into the Mexican Gulf: the Usumacinta (length 500 miles; basin 28,200 square miles); the Chixoy, 500 miles; the Rio de la Pasion, over 600 miles; the Rio Grijalva (440 miles; basin 19,700 square miles).

The Motagua is the largest stream flowing into the Caribbean Sea, 258 miles long, 660 sq. miles basin; the Polochic, 190 miles; the Belize, 170 miles. All the chief streams of the Caribbean region are navigable in parts of their courses. The New River, the Belize, the Sarstoon, and the Polochic can be partly used by steamers, and the Rio Hondo is navigable for flat-bottomed steamers. The Grijalva and the Usumacinta are also navigable for steamers in their lower course, the former also in its middle course from Chejel to Chiapa. The Usumacinta is also navigable above the waterfalls of Portal, Porvenir, and Anaite, and not merely the main river but also numerous tributaries. On the Pacific side only the Naranjo, Michatoya, Lempa, and Rio Grande de S. Miguel are navigable for short stretches.

The mouths of the Grijalva and the Usumacinta must be old deltas which have been transformed by the sinking of the land. True modern deltas are found at the mouth of the Polochic and the El Sauce and the Yzabal Lake or Golfo Dulce. The Golfo Dulce or Yzabal Lake is about 280 miles square in area.

The Soil.

Dr. Sapper confesses that he is not well provided with data on this subject, but cannot refrain from saying a few words on it, seeing that, as shown in Berghaus' *Physical Atlas*, hardly anything is known of the soils of the region. Possibly the covering of the greater part of the country might be described as laterite, but in most places the clayey soil exhibits marked differences from the red ferruginous soil, with nodules of sandstone or hydrated peroxyde of iron, usually distinguished by that name.

A soil map would in the main be a copy of the geological map were it not for transport and deposition by water, wind, and volcanic eruptions, and the changes produced on the surface rocks by climate. The former factors are of only local significance in a great part of northern Central America, but the variety of climate exercises a marked influence on the formation of the soil, either directly or through the vegetation. Such rocks as are susceptible to chemical decomposition, and at the same time owing to their composition are unable to offer much resistance to mechanical disintegration (crystalline schists, granite, diorite), are most affected by climatic differences. In damp regions the disintegration of the rock by the carbonic acid in the water, the action of vegetation, and the relatively high temperature, is carried down to great depths, while in dry countries mechanical disintegration is promoted by a large range of temperature on the surface, the vegetation being often too scanty to prevent direct insolation. And while in the damper regions the surface is nearly always saturated with moisture, in those parts where prolonged droughts occur it is dried up, and the particles of soil, instead of being compacted into clay or laterite, are loose, and where the slope is fairly great, are swept away by water and wind. Hence in these places there is a certain equilibrium between disintegration and transport.

Mica-schist, gneiss, and granite occupy large areas in the dry regions, and on the steep slopes of the mountains their constituents lie loose on the surface, with the exception of felspar, which, converted into a clayey mass, is often the first to be swept away by water and wind. Where the air is moister and the vegetation more luxuriant, the felspar remains on the ground, forming a deep black loose soil, with a large admixture of humus. The granitic mountains are generally covered with coarse quartz sand, and therefore the vegetation on the dry parts is still more scanty than on mica-schist or gneiss. The serpentine regions are the poorest, the soil being very thin or quite absent. Oaks and fairly dense fir-woods grow in the dry regions on mica-schist and gneiss, firs are more numerous than oaks on granitic ground, and hardly any trees but firs are seen on serpentine.

In the rainy forest tracts laterite is produced by the weathering of the rock, and attains a great thickness, as the rock is disintegrated to a considerable depth. This is especially the case with the serpentine, the laterite from which is, judged by its colour, the richest in iron of any soil in the country. A similar laterite is formed from quartz porphyry, while the soil derived from mica-schists, gneiss, granite, and

diorite, is lighter in colour. The cabbage palm (*Oreodoxa regia*) is almost entirely confined to the fresh laterite of damp tracts.

In the hollows of Lanquin, Cahabon (Alta Verapaz), and El Real (Chiapas) the Tertiary marls and sandstones occupy an isolated region, where the soil is a red laterite derived from transmutation of the marl, which itself seems to have originated from old laterite soil. A laterite, with nodules of sandstone, has also been formed from the grey marl on the coastal plain of south-east British Honduras; and in the moist districts of Chiapas, central Guatemala, and Petén, the Tertiary marls are transformed into a light-coloured red or yellow laterite.

In limestone regions a ferruginous clay is produced by the removal of the particles of the rock from its impurities, which remain behind. It is usually of no great depth, and varies according to the climatic conditions. In dry districts, exposed to intense insolation, this residual clay soil is red in colour and resembles laterite, containing also sandstone-like concretions and iron nodules. This soil is particularly conspicuous in central Yucatan. In the troughs filled periodically with water, in Yucatan and Petén, the clay soil becomes dark grey or black through the admixture of organic matter: curious small-leaved trees, including logwood (*Hæmatoxylon Campechianum*), grow in these hollows. Many palms, such as the cabbage palm and Corozo palm (*Attalea cohune*), avoid the residual clay soil, while others prefer it.

Another class of soils are those formed by matter transported and deposited by wind and water. Æolian deposits are of no great extent in northern Central America, but alluvium lies in considerable quantities in Tabasco and British Honduras, and along the river beds of Guatemala and Spanish Honduras. Sandy soil of marine origin occurs in the Pine Ridges of British Honduras, and the coastal plain of Chiapas near Tonala.

Loose volcanic ejectments are widely distributed. Soil of purely volcanic origin covers immense areas. In consistency it approaches the löss of temperate zones. Owing to its great porousness a steppe vegetation with fruit trees grows on it, and with sufficient water it becomes very fruitful. In some places it has mingled with the products of weathering, as, for instance, near Coban and S. Cristobal (Verapaz). Where volcanic tuffs lie in flat hollows, and stagnant water collects on them from time to time, the ground consists of a grey clay mixed with organic remains, and in the rainy season becomes a viscous mud, while in the dry season the surface dries and splits. These patches are covered with a peculiar vegetation adapted to the changing conditions; the most characteristic form is the *guacal* (*Crescentia sp.*). In the river plains of central Guatemala, Honduras, and Salvador, and the Pacific coastal plain, volcanic and alluvial material is mixed, and the soil approaches more to a pure volcanic or pure alluvial character as either material predominates.

THE TIAN-SHAN: ITS GROUND PLAN.[1]

THE name Tian-Shan or the "mountains of heaven," seems to have been applied by the Chinese only to the eastern part of the system now so called, about from the Khan-Tengri to Barkul. Farther west the highlands were known as the mountains of the Tsung-ling passes, from the large quantities of wild garlic that grow there. The first Russian explorer, Semionof, on the other hand, applied the term to the whole mountain land west of the Khan-Tengri, that is, the main mass south of Issyk-kul, separating from it the Trans-Ili Ala-tau and the Dzungarian Ala-tau. But now both the Chinese Tian-Shan in the east and the Tsung-ling ranges in the west, as well as the Ala-tau may all be grouped together, and the tectonic conditions and lines of strike indicate that a regular Tian-Shan system exists. Its main ranges, narrow in the east, spread out in a fan shape towards the west, repeating in the details of their articulation the general features of its configuration. The Tian-Shan proper will here be described; the Hindu-Kush forms a range by itself, the Alai is intimately connected with the Pamir, and the Tarbagatai, owing to its prevailing north-west strike, may be grouped with the Altai. All that lies between this and the Pamir Alai on the south may be attributed to the Tian-Shan proper.

The commencement of scientific exploration in the Tian-Shan dates from the time when the system was partly incorporated in the fast expanding Russian Empire after the middle of the present century. Colonisation advanced hand in hand with scientific research by Russian travellers. The first of these who, by travelling across the trend of the mountains, brought back valuable information regarding their configuration, were Semionof (1856-57) and Severtsof (1864-68). Their immediate successors, Poltoratski, Kraievski, Von Osten-Sacken, Reinthal, and Baron Kaulbars, added many valuable supplementary details, and Regel and the brothers Grum-Grzhimailo, though the former was a botanist and the latter entomologists, contributed to the geographical knowledge of the system. The great discoverer Przhevalski and his successor Pievtsof only passed through on their way to other regions. Of later explorers the most important are Romanovski, Mushketof, Bogdanovich, and Obruchef, while many others have visited this part of Asia whose objects were not strictly geographical. Mushketof's journey is of great importance as regards the geology and geography of the country, as he was sent out to inquire into its mineral wealth, but unfortunately only one volume of his work has been published, in which his observations on the middle Tian-Shan are not included. Romanovski's palæontological investigations furnish a basis for the classification of the sedimentary formations, while Bogdanovich and Obruchef have contributed towards the solution of purely tectonic problems relating to the Tian-Shan and its neighbourhood.

[1] Abstract from *Morphologie des Tien-schan*, by Dr. Max Friederichsen. *Zeitschrift der Gesell. für Erdkunde zu Berlin*, No. 1, 1899.

The Tian-Shan lies between 40° and 46° N. lat.—that is, in the latitude of northern and central Italy—and between 68° and 92° E. long., extending over 24 degrees of longitude. If the 43rd be taken as the central parallel and the length of a degree of longitude on it as 50·6 miles, the length of the system is 1214 miles, or more than double that of the Alps.

The most marked feature of the Tian-Shan is the regularity of the direction and arrangement of its ranges. This regularity prevails throughout the system, for the massives and plateaus usually lie in a longitudinal direction, or on nearer inspection resolve themselves into closely packed parallel chains. Though many of its ranges deviate from the east and west direction under various angles, yet on the whole the mean trend of west by south to east by north prevails. More or less closely adhering to this direction, the mightiest members of the system, in the west developing into numerous parallel ranges, and in the east diminishing in number and breadth, stretch from the depression of the Aralo-Caspian basin to the deserts of central Mongolia. The gentle curve distinctly presented by the configuration of the system is due to the ranges running down from the north-west to the extremities of the northern lateral chains. As a large river forces its weaker tributaries into its bed, so the Tian-Shan impresses on these northern ranges its own direction as far as the eastern side of Bogdo-ola, where it shrinks into a single chain, and the north-western ranges, becoming the more important, make their own strike prevail.

This arrangement involves many other consequences. It throws the courses of the streams into the longitudinal valleys, and forces them to turn where the north-west sections begin. At the bends human settlements find shelter and protection. Through divergence and expansion this mountain region throws itself open to traffic from the west, and presents a barrier against it on the east. Between the parallel ranges are basins which have long been the home of prosperous settled tribes, frequently thrust out of their lands by invading nomads from the neighbouring steppes. The latest intruders into the sheltered oases of the Tian-Shan are the Russians, who found an easy entrance through the open fan-shaped expansions on the west.

Round about the mountains lies a girdle of deserts and steppes. Deep depressions surround the foot of the mountains filled with deposits of Tertiary seas, as in the Aralo-Caspian basin, and covered superficially with æolian accumulations of sand and dust, which have softened down their contours. Between the Tian-Shan and the Altai stretches the Dzungarian desert, while between it and Tibet lies the Tarim basin; the eastern spurs vanish in the Shamo desert, while the western elevations abut on the Aralo-Caspian wastes. Even the belt of oases at the foot of the mountains suffers from its vicinity to these deserts. Gradually advancing towards the mountains the devastating sand threatens to overwhelm the narrow fruitful strip of land between the highlands and desert.

Dr. Friederichsen makes no attempt to divide the Tian-Shan exhaustively into sharply distinguished groups, but treats only of the

general characteristics of its plan. He therefore takes the following groups :—

1. Ranges running north-westerly—west by north, west-north-west to due north-west.

(*a*) On the northern edge of the system.

(*b*) In the interior.

2. Ranges running north-easterly—east by north, east-north-east to due north-east.

He denotes the former category, especially 1*a*, by the name of the Kara-tau system, implying by this term solely a uniformity in the direction of the ranges, not necessarily involving a genetic connection, while the Tian-Shan system comprises the ranges running from east by north to west by south.

1. Ranges running North-west.

The Kara-tau, the largest of the north-west running ranges, beginning in lat. 45° near the Syr Daria, passes on, supported by a parallel chain on the north-east side, almost due south-west towards the Tian-Shan. Its south-western flank slopes gently down and abounds in oases, while its north-eastern ends abruptly in desolate sandy wastes and steppes. How it is connected at the south with ranges having the Tian-Shan trend is doubtful. That such a connection exists is certain, but that it is effected by a junction with the extremity of the Alexander range is not in accordance with the existence of the flat desert plain described by Severtsof, between the Talas and Assa, two streams which lose themselves in the salt lakes of the desert. In Severtsof's section also, a low flat, on which Aulie-ata stands at a height of only 2460 feet, separates the Kara-tau from the Alexander range. On the other hand, the same traveller has reported a connection of the Kara-tau with the Talas-tau of the Tian-Shan system. On the march from Aulie-ata to Chimkent he crossed by an inconspicuous pass (3600 feet) a ridge called Kulan, running in an almost meridional direction, which appears to form the connection spoken of. From the Kulan the main range of the Kara-tau appears to run north-westwards, with a simple crest sometimes very lofty, accompanied in its southern portion by an insignificant subsidiary range, the Kochkene Kara-tau (Little Black mountain), which slopes down to the Muyun-Kum. Between the ridges lie Jurassic deposits with valuable seams of brown coal.

Much farther west, the two main directions again come into contact east of Merke, where the western half of the Alexander range shows a marked inclination towards the Kara-tau trend. Severtsof divided the present Alexander range into two sections, denoting the eastern half by this name and calling the western half the Kirghiz Ala-tau. On the meridian of Merke the strata still strike west-north-west and east-north-east. More to the east, at the Kumbel pass, the point is approached where the Tian-Shan direction begins to prevail. Here is also a geological boundary, for east of the 74th meridian the carboniferous and Devonian formations, so common to the west, are absent from the northern flank of the mountains.

Following the northern edge of the Tian-Shan further, we find a hilly zone accompanying the river Chu, having a main axis in the Kara-tau direction. From the south-west corner of Lake Balkash these heights pass on to meet the snowy elevations of the Trans-Ili Ala-tau. Though no scientific traveller except Romanovski has visited them, their north-west trend may be accepted as certain from the Russian surveys. Probably the geological strata have the same strike.

Less prominent in relief, but still important in the horizontal orographical arrangement, are the ranges on the northern skirt of the Dzungarian Ala-tau. The extremity of the range which continues the main axis of the Ala-tau shows a distinct north-westerly trend south of Kopal, where it goes by the names of the Uch-kara hills and the Bura-koi mountains, and beyond the gap formed by the Ala-kul the same tendency becomes again prominent in the Tarbagatai. Beginning as the Chenghis-tau between the Irtysh and Lake Balkash, this range proceeds with a strictly north-west trend to the country south of Zaisan-nor, where gradually swerving round to the Tian-Shan direction it ends as Zemis-tau in the desert of Dzungaria. A little to the north, beginning at the Zaisan-nor, two chains, the Manrak and Saur-tau, approach the former, and like it swing round towards the east in the lofty Mus-tau (12,300 feet), and terminate as a low range, the Kara-adyr, at the Uliungur lake.

Though the extremities of all these ranges bend decidedly into the Tian-Shan direction, the Kara-tau ranges cannot be said to fall here into line, for the Tian-Shan direction plays a subordinate part, and the Tarbagatai and its companions should rather be reckoned with the Altai system than be regarded as the most northerly outposts of the Tian-Shan. The last members of the Tian-Shan proper are the spurs of the Ala-tau axis beyond the Ala-kul and Ebi-nor gap, coming into contact north of Orkhu-nor with the extremities of the Tarbagatai. This meeting-place of the Altai and Tian-Shan ranges is not well known. With regard to the accessibility or otherwise of the Dzungarian desert, the effect of the curving of the extremities of the Tarbagatai ranges is of importance. Instead of a number of convenient exits between parallel ridges, a barrier is often interposed by crossing ranges.

Passing down the Urungu river south-eastwards and crossing the connection with central Mongolia known as the Dzungarian arm, we come to another point where the encroachment of the Altai ranges interrupts the east and west course of the Tian-Shan as the Tarbagatai does farther north. The Mechin-ola and its neighbour, the Karlyk-tagh, in the neighbourhood of Barkul, indicate by their north-westerly strike their connection with the Altai. Just as in the case of the Tarbagatai their southern ends swing round, but the north-west trend predominates. The Mechin-ola shows this the most plainly, merging with the Karlyk-tagh at the Soochi pass, but in its further course turning more eastward and sinking to low rocky elevations. The change begins at 95° E. long. The Chinese speak of an A-tsi-shan coming from the north-west and bending eastwards. On Klaproth's map these mountains appear as the Adzidabahn to the north-east of Khami, and possibly the

Tostu and Noïnbogdo ranges in eastern Mongolia, crossed by the last expedition of Potanin, may be parts of it, and form a prolongation of the Karlyk-tagh. Of the structure of these ranges no details have been obtained, and therefore the question whether the Mechin-ola and Karlyk-tagh belong to the Altai, must be left undecided.

In the absence of fuller information on the geology and structure of the mountains, their ramifications can only be classified on the base of their prevailing directions, but the Mechin-ola cannot be with confidence regarded as an offshoot of the eastern half of the Karlyk-tagh, especially as the main north-westerly line of upheaval may be traced, only superficially covered with débris, far into the Dzungarian desert. The Khara-syrkhe and Kuku-syrkhe, crossed by Przhevalski, and even the heights scattered over the steppe south of the Urungu river, exhibit the Altai orientation.

Not only is the Karlyk-tagh closely connected with the Mechin-ola, but also the Barkul mountains, which form with it an angle occupied by the dreary Barkul plateau. The question is whether these belong to the Tian-Shan system. Their direction is west-north-west to east-north-east, which not uncommonly occurs in the Tian-Shan ranges, especially east of the meridian of Khan-Tengri. The question is complicated by the existence of a very marked dip, observed by the brothers Grum-Grzhimailo, between the western end of the Barkul mountains and the steep slope of the Bogdo-ola range running towards it from the west. This dip, lying between 91° and 92° E. long. at Otun-koza (absolute elevation 2390 feet), is called by the brothers Grum-Grzhimailo the end of the Tian-Shan.

From a purely orographical standpoint this view may be justified, unless further inquiry should show that the Bogdo-ola, cut short at the dip, again crops up in the small Choglu-chai and range of Yanchi, somewhat indistinctly marked on Grum-Grzhimailo's map as running towards the Barkul mountains. However, in the meantime Otun-koza may be held to mark the extremity of the Tian-Shan, while the closely connected chains of the Barkul mountains, Mechin-ola, and the Karlyk-tagh, may be regarded as the first of the Altai system.

Whether the north-westerly trend occurs in the Bogdo-ola is still uncertain, though the group has been described by several recent travellers, but Chinese descriptions, the sheltered situation of Urumchi, and the fact that the Jargoz running east and west abuts at an acute angle on the Bogdo-ola, seem to point to a north-westerly deviation of the axis of the latter.

Farther along the south side of Dzungaria the change of direction of the western part of the Iren-khabirgan chain is so far modified that the range does not pass north-westwards uninterrupted into the deserts and steppe lands, but is cut off by the intervening ranges of the Dzungarian Ala-tau. It can scarcely be doubted that the Iren-khabirgan does not trend from east by north to west by south, the prevailing direction of the western Tian-Shan. The mountains seem rather to pass gradually in a curve from east and west in the eastern part to due west-north-west in the western. Whether this direction is confirmed by the strike of the strata must be left to future investigation.

Taken as a whole, the Iren-khabirgan range consists of a double chain connected in the source region of the Manas by a snow-covered crest. The southern chain, apparently uninterrupted, passes into the Bogdo-ola range, continuing to the dip at Otun-koza, while the northern, to which the name of Iren-khabirgan more strictly belongs, is sharply separated from the triple-peaked giant of the Bogdo-ola by the hollow of Urumchi. On the west, in the region of the Zairam-nor, turning more and more to west-north-west, it is intimately connected with the Dzungarian Ala-tau. At the same time its southern range, called here the Avral mountains, terminates at about long. 82°, where the Kunges and Kash unite to form the Ili, with a westerly trend, according to Regel and Przhevalski.

The meridian of the lake Ebi-nor marks a division in the northern range, which on the west of this line expands to enclose high plateaus, while on the east it shrinks to a simple ridge. The boundary between the two sections is about where the west-north-west direction begins to prevail. In height, too, the sections are different; snow and large glaciers lie on the crest in the east, while on the west are considerable dips which facilitate traffic.

Semionof represents the western half of Iren-khabirgan as meeting the Dzungarian Ala-tau at an acute angle. This depends on the direction of the latter, which Semionof states to be north-east, but the Russian surveys subsequent to 1858 give its main range a trend from west by south to east by north, the same as that of the principal ranges of the western Tian-Shan, and this corresponds to the strike of the schists which predominate in the Ala-tau and dip at considerable angles north-north-west. But Semionof, though mistaken in the true direction of the main axis, observed the parallelism of the ranges on the north side of the system, and the transition in the west to a series of ranges in the Tian-Shan direction. The Kopal chain, which he oriented east and west, is now known to be simply a continuation of the lofty main range of the Ala-tau, and the next parallel chain, the Diangys-Agach is an offshoot of the Kopal. Then comes the Labasy passing eastwards into the highlands near Zairam-nor. The range called Bejin-tau by Regel, separating the longitudinal valley of Borotala from that of the Urtak-sary, can hardly be anything but a prolongation of the Labasy, while the elevations which Semionof lays down east-north-east to west-south-west, beginning at the bend of the Ili, the Altyn-imel and Alaman, bend in a gentle curve into the heights north of Zairam-nor and terminate in the Kanjiga mountains at the bend of the Borotala. Accordingly, there is apparently nowhere any disturbance in the orographical arrangement or geological structure of the Tian-Shan ranges which run up to the Ala-tau with great regularity, and seem to be connected with it by a crest parting the valleys of the Borotala and Kok-su. That this is not a valley parting but a transverse connection between parallel ranges is proved by Regel's mention of a sea of lofty snow-covered peaks, 12,000 to 14,000 feet high, in the source-region of the Kok-su and Urtak-sary.

As the Bejin-tau, Labasy-tau, and the chain skirting the northern

side of the Zairam-nor range themselves parallel to the Ala-tau, so the west-north-west trend of the ranges south of the lake marks them out as distinct from the former, and more closely connected with the west end of the Iren-khabirgan. There seems, however, to be no direct contact with the Dzungarian Ala-tau. The hollow occupied by the Zairam-nor prevents this. Besides, Regel says of the Ak-su mountains south of this lake that they do not continue westwards in the form of a range but, joining the slope of the Alaman range south of the Urtak-sary river, form the immediate background of the valleys of the Ak-su, Khorgos, Össek, and Borokhudsir, tributaries of the Ili.

The west-north-west direction may be traced as far east as the 82nd meridian. East of the Talki pass on the old Chinese imperial road lies the Bogdo or Kuyuk chain, also running west-north-west. On its southern slope its descent to the Ili is effected by a series of tablelands, of which the westernmost, the Kok-kamyr, seems to be bounded by the Bogdo mountains on the north-east, and the north-westerly running Talki range on the south-west. Up to the meridian of the Tsiterte pass it is continued by the Turasu plateau, which gradually contracting ends in a simple ridge, the northern chain of the Iren-khabirgan.

1 *b*—Ranges in the Interior of the Mountains running North-westwards.

Turning to the interior of the eastern half of the Tian-Shan in search of ranges running north-westwards, one's attention is immediately attracted to the neighbourhood of the Yuldus valleys, where the enclosing ranges, like the western Iren-khabirgan, deviate considerably from their original Tian-Shan direction. These two valleys are separated from one another by a series of mountains running west-north-west to east-south-east, and connected hydrographically by the Yuldus river, called in its lower course the Khaidu-gol. Flowing at first west-north-west, it turns sharply round the end of the Khaidu-tagh, and runs east-south-eastwards to the Bagrash-kul. On the south it is separated from the Tarim basin by a range also trending west-north-west and east-south-east. Geological observations on the dip and strike in these ranges being totally wanting, this district is at present one of the most mysterious parts of the Tian-Shan; but the direction of the ranges and of the similar orientation of the elevated valleys seems to be certain.

Where the Khaidu-tagh descends to the gravel steppe around Bagrash-kul (3000 feet high), the Tian-Shan passes into a dreary plateau, begirt with heights which for long distances maintain a west-north-west direction, and it may be asked whether these are a prolongation of the Tian-Shan. Much uncertainty has prevailed on the orography of this region, and it has only been possible to draw up a correct plan of the country since the publication of Grum-Grzhimailo's work and the clear accounts of Obruchef. The Khaidu-tagh disappears as the Tsagan-tiunghe in the Pei-Shan plateau, and the ranges that rise in large numbers on the Pei-Shan in the east have no direct orographical connection with it. On the other hand there is a connection with the ranges skirt-

ing the Pei-Shan on the north and south. Pevtsof's Borto-ula and the Arghy-tagh pass immediately into the Chol-tau, sinking abruptly towards the north to the deep depression round Turfan. Again, the Kok-teke, stretching south of the Khaidu-tagh from the west-north-west, is closely connected with the Kuruk-tau (dry mountains). The latter, intersected by the ravine of the Konche-daria, extend, according to native reports, uninterruptedly south-eastwards to Sa-chau, forming the southern boundary of the Pei-Shan towards the basin of Lob-nor and the channel of the Bulunghir-gol. Lofty in the west, it soon sinks eastwards to a broad flat ridge, which, Przhevalski states, is resolved into hills of clay and sand, and finally disappears in the desert. But the same traveller speaks of a low range of rocky, rounded hills near Sa-chau running across the desert, and falling to the Bulunghir-gol in an escarpment 1000 feet high.

The prolongation of the northern edge of the Pei-Shan plateau, the Chol-tau, has also been observed along the old Khami-Sa-chau route near the Kufi well.

Recently the brothers Grum-Grzhimailo have described the Pei-Shan as a labyrinth of hills running for the most part west-north-west or west, and so similar in appearance as to be hardly distinguishable. Conspicuous among them is the Tiughe-tau, wild rocky ridges with a relative height of 4000 to 4900 feet. West-north-westwards is the Sinir range, and north of it the long steppe mountains of the Kugushin-tagh.

The eastern part of the Pei-Shan presents much the same picture. All travellers on the route from Khami to Sa-chau have crossed more or less regular systems of hills running east and west or east-north-east to west-south-west. Potanin has inserted them in his map farther east at the Edzin-gol, and they show the constant character of the Pei-Shan plateau, which in no part is of great breadth. In the meridian of Lukchun its breadth is about 125 miles, of Khami 100 miles or a little more, Sa-chau 75 miles, Yy-min 125, and at Edzin-gol 75 to 80 miles. The wearisome monotony of the old folded ranges is the results of long-continued weathering and the filling up of former valleys with rubbish from the heights above. The geological observations of Bogdanovich, Obruchef, and others show this country to be the ruins of a part of the Earth's crust subjected, apparently since Mesozoic times, to violent folding and upheaval. Its low ranges, in spite of their similarity in direction, and in some places close connection with the Tian-Shan, contrast in their geological history and their morphological character with the more recent Tian-Shan, and rather present the aspect of a Kuen-lun in miniature.

Another region in which the harmony of the Tian-Shan system is broken in upon by ranges running north-westwards, is the north-eastern border of the Ferghana basin. The total absence of such an orientation among the inner ranges of the western Tian-Shan renders this case peculiarly remarkable, and it was noticed by Humboldt, who looked upon the Ferghana range as a northern prolongation of his Bolor mountains, and the Kara-tau as its last ramification. The existence of a north-west orientation in the Ferghana mountains is fully accepted. Travellers

have crossed the range, and marched along it for long distances, while its great height is proved by the presence of a number of glaciers and snow-fields. It remains only to inquire into its relation with the ranges approaching it from the Naryn highlands.

The Uyurmen-cheku ends before it reaches the Ferghana range, while the Jaman-davan is separated from it by the narrow valley of the Arpa which washes the foot of its abrupt extremity. The Makmal sends forth a saddle forming a watershed, and the west end of the Kokirim-tau, when it adjoins the Ferghana range, has already assumed the mean Tian-Shan direction—east-north-east to west-south-west. Such a cutting off of ranges running westwards by a transverse elevation calls to mind a similar phenomenon in the Pamirs, and on comparing the two cases it may be conjectured that the sinking of the Ferghana basin may have been accompanied by a thrusting aside of the extremities of the chains into a north-westerly direction.

The outward similarity with the configuration of the Pamir is heightened by the position of the Ferghana chain in the direct prolongation of the Pamir line of upheaval. And the Alai and Trans-Alai, just as they lie across the Kashgarian mountains on the edge of the Pamir, so do they run up to the transverse range of the Ferghana. The diabase ranges near Gulcha at the corner of the Ferghana basin, which run north-west, seem to blend imperceptibly with the Kashgar-tau. The Suyok-tau, the south-eastern part of the Ferghana range, merges into the Terek-tagh (or Kurpe-tau), stands in a line with the Alai ranges, and comes to an end in the lofty Kokiya mountains at the narrow valley of the Ak-sai. Whether the main range of the Alai is directly continued by the Kashgar-tau, finally terminating at the Taushkan-daria in the Kara-teke mountains of Pevtsof, is an open question. Stoliczka's southern Artysh range may perhaps be continued in the Chili-tau which, the natives say, joins the Kara-teke. At any rate, the Alai is here in close connection with the Tian-Shan system, and may very justly be regarded as belonging to it. On the other hand, the narrow connection in the neighbourhood of Terek-davan, compared to the broad dividing Ferghana basin, and the much closer union of the Alai with the Pamir, permit the limit of the Tian-Shan to be drawn for the purposes of geographical definition at the Terek-davan pass. Otherwise the Pamir and the Hindu-Kush must also be included.

2. Ranges running North-east.

As far as can be judged from the orography, and more particularly the geological structure, of the ranges north and south of the Issyk-kul, their direction varies between east by north to west by south and east-north-east to west-south-west to due north-east, but never approaches north-west. From the Ferghana range eastwards extends a mountain land which repeats in miniature the configuration of the whole Tian-Shan; a narrowing eastwards through the failure or drawing together of the main ranges and a fan-shaped divergence at the western end.

Prominent among the ranges south of the lake is the Terskei Ala-tau. From the reports of travellers it seems to be a lofty chain running from the Khan-Tengri massive on the east-north-east, turning westwards south of the Issyk-kul, crossed by the Juvan-aryk in a deep transverse valley, and continued geographically and geologically in Kaulbars' Son-kul mountains. The existence of a saddle on the meridian of the Son-kul, a convenient passage used by many travellers, does not forbid the assumption that the line of elevation is continued in the Kara-kol mountains and beyond another deep cross valley, the Susamyr, in the Susamyr-tau. This is suggested by Mushketof on the ground of the geological structure, and is accepted by Suess. On the northern side of the Terskai Ala-tau, between the extremities of the lake, runs a subsidiary chain.

South of, and parallel to, this great continuous range lies a mountain land divided into sections by cross valleys and other interruptions of the crest, south of which the Naryn follows in a course due east and west. Commencing at the sources of the Naryn, it is broken through by the Little Naryn, the Onarcha, and the Naryn itself, and as the Kokirim and Chichikty mountains runs up to the Ferghana range. The various sections have been crossed by many travellers, and their positions and geological formation sufficiently determined, so that it may with some confidence be affirmed that it runs west by south and east by north, probably having formed in earlier times one continuous chain. It is prolonged beyond the sources of the Naryn in the Ak-shiriak and Kiului mountains which, deviating somewhat to the east-north-east, make for the Khan-Tengri massive.

A great contrast to the regularly disposed chief ranges north of the Naryn river and their mean east by north orientation, is the district to the south, which by no means conforms to the usual regularity of this part of the Tian-Shan. This is the great curve of the Kok-tal-tau that appears on most Russian maps, stretching in a grand sweep from the Ak-sai breach to the Khan-Tengri. It appeared first on Petermann's map in the Ergänzungsheft 42 to *Petermanns Mitteilungen* to illustrate Severtsof's travels, though there was no sign of it on the original Russian map. Long stretches of the outer ranges of the Tian-Shan towards the Tarim basin have not been visited by any expedition. Some routes lead from the other side to the foot of the mountains, but the Bedel pass and the road from the Chatyr-kul to Kashgar are the only long-known and much-frequented routes.

In the neighbourhood of the Chatyr-kul, the southern boundary of the Tian-Shan is formed, as mentioned above, by a prolongation of the Alai in an east-north-easterly direction as far as the breach made by the Ak-sai. North of this point Severtsof saw a range which he called Bos-adyr, placed on his map from east by north to west by south. North of this again a range is reported by Kaulbars, which he named Kuberghenty, lying in the same direction. Westwards it is prolonged in the Sary-tas, which is separated only by a plateau-like steppe from a mountain which, adhering to the axis of the former ranges, turns presently west-south-west to Chatyr-kul—the Uyurmen-cheku. This

line of elevations, then, runs with interruptions from the lake to the Tarim basin, where it ends at some point not yet fixed.

North of, and exactly parallel to, the Kuberghenty, Kaulbars followed a range he called the Bor-koldai, and in the same axis westwards lie the Chakyr-tau, Karagai-tau, and the Myshat-tau of Severtsof, along the southern bank of the Naryn, leading up to the Bai-biche-tau and Koikagar-tau in which a west-south-west direction is gradually assumed as the Ferghana range is approached. At its eastern end the Bor-koldai is piled up in huge masses (the Catherine and Peter summits for instance) up to the cross valley of the river which, as the Sary-jas, receives all the water from the glaciers of Khan-Tengri and the neighbourhood. Where exactly the breach lies through which the Janart flows is not precisely known, but that it exists is proved by the hydrography of the Sary-jas basin, and by a large mountain stream entering the Taushkan-daria near Uch-Turfan. Probably the river makes its way round the end of the Bor-koldai, just as the Ak-sai round the Kokiya mountains.

Probably the limit of the Tian-Shan towards the Tarim basin consists of the extremities of these parallel ranges, and here these ends seem to attain their culminating heights. Such are the Nicolas peak in the Kokiya mountains, 16,700 to 17,700 feet high according to Kaulbars' estimate, the summit he conjectured must exist at the end of the Kuberghenty range to feed the head streams of the Miuduriun with such abundance of water, and the peaks of the Bor-koldai mentioned above. Thus the narrowing of the Naryn highlands is caused by the successive dropping behind of the southern ranges.

In the Bor-koldai the ranges lying to the south of the Naryn reach their farthest eastern limit. All those which lie beyond the Janart breach belong to the series lying on the north side of the river. Here we approach the loftiest point of the Tian-Shan, and one that has been little explored—the pathless region of the glacier-clothed Khan-Tengri.

Since Ignatief and Krasnof completed the reconnaisance commenced by Semionof and Kaulbars, the general plan of the country is known, though the two latter travellers kept chiefly to the valleys, thereby obtaining a better sketch of the hydrography, but no great result as regards the orography. Nevertheless, they ascertained that the strike of clay-shales and chlorite schists near the Sary-jas, as well of the mountain limestone, have a north-easterly strike, thus agreeing with the orographical plan.

Semionof spoke of parallel structure in the Khan-Tengri, and though his successors do not mention it, his view seems to be not improbable. No proof of its correctness can be alleged, as no exact information about the southern slope of the Tian-Shan east and west of the Khan-Tengri has hitherto been obtained. The pass of Mussart over the range shooting out westwards from the Khan-Tengri is certainly known from Chinese and later sources, but whether the Sary-jasy chain of Ignatief, east of the Janart valley, proceeds as far eastwards as the Mussart pass or beyond it, or whether it ends on the Khan-Tengri, is not known. At any rate, the Russian maps represents the main axis of the Khan-Tengri crossed

by the Mussart pass as continued eastwards in the Chalyk-tau. On the west the Kiuliu and Ak-shiriak lie on this axis.

The third range, approaching the Khan-Tengri from the east-north-east, lies in the same line as the eastern end of the Terskei Ala-tau. If the Russian map correctly represents the tributaries of the Tekes as running in clearly marked longitudinal valleys, breaking through to the north and falling into the main stream at right angles, it is easy to reconcile this valley formation with the plan of the mountains, and to assume a connecting link between the Terskei Ala-tau and the Narat mountains. From general considerations, therefore, Semionof's suggestion of the parallel structure of the Khan-Tengri district seems not improbable.

The Khan-Tengri is then situated at the point where the ranges are most compressed, approaching it from the west-south-west and passing on towards the east-north-east. On the western side, where these ranges diverge most, broad elevated plains lie between them, in some parts assuming the character of high plateaus generally more than 6500 feet above sea-level. These plains are very characteristic, and produce a certain contrast between the Khan-Tengri highlands to the east of the meridian of the Naryn sources and the Naryn highlands to the west of this line.

Extending in the same west by south direction as the Naryn highlands, the double chain of the Trans-Ili Ala-tau follows the northern side of the Issyk-kul. Its eastern continuation, the Temurlik-tau, starts at the confluence of the Tekes with the Kunges, and has the same direction. Semionof in 1858 travelled in the Trans-Ili Ala-tau and drew up a clear plan of it. He distinguished two ranges united by a lofty cross ridge, accompanied by a subsidiary chain of porphyry, and separated from one another by two intermediate chains. These two main ranges are built up of Archæan schists and Carboniferous limestones in folds stretching west by south to east by north, and masses of syenite similarly disposed.

While the northern range leads up to the Mainak and farther on to the Chu-Ili mountains, the southern range is continued without a break, both as regards direction and geological composition, in the east half of the Alexander range, though the Chu breaks through between these elevations which were formerly closely united.

The relations of the Alexander chain to the Talas-tau and the western prolongation of the Terskei Ala-tau are not so easily decided. A connection between the eastern half of the Alexander chain and the Talas-tau is rendered probable by the reports of Kaulbars and Mushketof and their measurements of heights, and also by the existence of a ridge parting the basins of the rivers Susamyr and Talas. The apparent geological identity of the Urak-tau (Talas-tau) with this watershed, and with the eastern half of the Alexander chain, points to the probable unity of the three elevations. As for the Terskei Ala-tau, perhaps it merges completely into the Talas-tau, perhaps it takes the form of a southern chain, sending out the Chatkal mountains to the south-west; but nothing definite is known about it. West of this very doubtful

point the lofty ridge of the Talas-tau may be traced as a prominent axis of elevation strengthened on the northern side by the addition of the Kara-tau, and sending its last spurs into the lowlands of the Syr-daria.

It is singular how little is really known of the mountains south of the Talas-tau, though their immediate neighbourhood—the low lands and hills of the Ferghana basin and the Syr-daria lowlands—are some of the parts of Turkestan best known topographically. The valleys south of the Talas-tau are drawn on Russian maps as running south-west in parallel lines, very probably guided by the structure of the country. According to Severtsof's and Regel's reports, the ranges appear, indeed, to run from the north-north-east, or occasionally north-east, but it is doubtful whether this direction is maintained as far as the Ferghana valley. Fedchenko draws them on the northern side of the valley from east by north to west by south.

Summary.

In the Tian-Shan two opposite deviations from the east and west line are observable. The one ranges from east by north to east-north-east, seldom reaching north-east, the other to west-north-west, frequently to north-west. The general direction of the whole system is west by south to east by north, and this is particularly frequent in the western part of the mountains—the Naryn highlands, the Trans-Ili Ala-tau and its prolongations. In the east, on the other hand, there is in addition a direction west by north to east by south, or frequently west-north-west to east-south-east, as in the Iren-khabirgan and the mountains of the Yuldus district.

The similarity of the double range of the Iren-khabirgan with that of the Trans-Ili Ala-tau is unmistakable. As the former stretches north of the Yuldus valleys in close relationship to them, so the Trans-Ili Ala-tau lies north of the Naryn mountains, where there is a similar development of high valleys. Again, the Dzungarian Ala-tau, though differing in direction, exhibits in the fan-shaped divergence of its western ranges great similarity to the arrangement south of the Talas-tau. To the Ferghana valley corresponds in situation, form, and agricultural value the fruitful plain of the Ili, while the Ferghana chain on the north-east of the valley is here represented by the curved ends of the Iren-khabirgan, and the Naryn, rising in a long parallel valley of the interior and as the Syr-daria flowing north-west to the Aral, is matched by the Kash and Kunges, continued in a north-westerly direction by the Ili which enters the Balkash lake.

A line drawn along the valley of the Ili and Kunges, and from the sources of the latter produced to the Tarim basin at Kucha, would separate the whole system into two parts differing from one another in the prevailing direction of their lines of elevation, but strikingly similar in outward character.

The general result of the variations in the direction of the ranges is to give the orographic configuration a curved form. The principal arcs, convex towards the south and concave towards the north, are those

composed of (1) the Dzungarian Ala-tau; (2) the Iren-khabirgan and Bogdo-ola; (3) the Alexander range, Trans-Ili Ala-tau (southern range), and Temurlik-tau; (4) the Mainak and Trans-Ili Ala-tau (northern range); (5) the Kara-tau and Talas-tau; and (6) the Susamyr and Terskei Ala-tau.

Dr. Friedrichsen will deal in a future paper will the vertical relief of the Tian-Shan.

THE EFFECT OF ICE-MELTING ON OCEANIC CIRCULATION.

THE east Iceland branch of the great Greenland Polar current leaves the main stream west of Jan Mayen, and passes in a direction almost due south to the north coast of Iceland and the Färoe islands, meeting between Iceland and the Färoes with the western branch of the Gulf stream, and running east of the latter against the other branch of the Gulf stream. The lighter water of the Gulf stream spreads over it, at least in summer, for in some winters the Arctic water flows over the surface, and penetrates into the deep Norwegian channel. The water temperature in this region has considerable effect on the temperature of northern Europe and the migrations of fish, as Professor Pettersson has shown (see *S.G.M.*, vol. xiv. p. 369), and therefore he has subjected this current to a thorough examination, obtaining the necessary data from the results of the *Ingolf* expedition in July and August 1896.[1]

The Iceland current has certain peculiarities. Firstly, though an Arctic stream, and carrying a considerable, if not the greatest, part of the water which escapes from the Polar sea to more southern latitudes, it moves somewhat to the east instead of being displaced westwards by the Earth's rotation, and this entails an expenditure of kinetic energy. Secondly, this powerful stream appears to be entirely lost in the Gulf stream water. Thirdly, the Icelandic current is in general free from ice. The position of the ice-limit in the summer of 1896, and the course of the isohalines of 34 and 35‰, being probably the boundary between Arctic and Atlantic water, give the impression that the Polar current bifurcates north of Iceland, the ice passing through the Denmark strait, and the main body of the Arctic water through the Jan Mayen channel. A closer inspection shows, however, that the Polar ice comes down in this direction also, but its course is checked by the excessive melting which occurs in this region.

The Polar current, after issuing from the Polar basin, carries ice with it only so long as it passes over the continental coast banks, where there is no room for a warm under-current. As soon as the floes and icebergs reach deep water they are exposed to the action of the Atlantic water, which produces a rapid melting on their lower surfaces. This happens in the Jan Mayen channel (880 fathoms deep), which joins the deep

[1] *Öfversigt af Kong. Vetenskaps-Akademien Förhandlingar*, 1899, No. 3.

trough of the Norwegian sea. Over this the Gulf stream spreads itself, the layer increasing in depth as the velocity of the current is diminished. The west side of this great surface layer is gradually covered, when the temperature sinks below 4° C., by West Atlantic (*i.e.* Arctic) water, and a voluminous current of Atlantic water flows through the deep channel between Iceland and Jan Mayen westwards against the pack edge, and effects the melting of the ice. In all the sections of the *Ingolf* expedition an under-layer, containing the maximum salinity and temperature, appears immediately below the level of minimum temperature. This is the under-current sent off westwards by the Gulf stream, which reaches even to the slope of the Greenland bank, where Ryder, in 1891, found a warmer layer in depths of 55 to 80 fathoms. A similar current keeps Davis' strait free of ice, and even penetrates into Baffin's bay over the threshold between Godthaab and Cape Walsingham.

The process of ice-melting was described by Professor Pettersson in 1878 and 1883, the following facts being demonstrated :—

(1) On the freezing of ice from the sea-water the latent heat of the water is reduced.

(2) The ice produced contains a small quantity of salt, which has a marked effect both on its chemical and physical behaviour.

(3) On freezing a separation of the solid particles takes place, the sulphate being collected chiefly in the ice, and the saline combinations in the water. When a limited quantity of water is frozen, which often occurs within the domain of the Polar ice, a strong concentrated lye is formed in the hollows of the ice in which the sulphate is exceedingly reduced. The old drift-ice of the Polar stream contains indeed only traces of salt; but, as the sulphate is in excess, it must be assumed that analysis of the water from melting will show a larger proportion $\left(\frac{100\ SO_3}{Cl_2}\right)$ than in the Gulf-stream water. This is the case, though the difference is so slight as only to be detected from the means of a large number of most careful analyses.

(4) Even mere traces of salt produce important changes in the physical behaviour of ice. The diminution of volume on melting is less, and the expansion of the ice by warmth is irregular, the co-efficient of expansion becoming zero several degrees below the melting temperature, and then negative. This circumstance has a close connection with the softening of the ice, and the plasticity of newly formed ice, which yields to the motion of the waves without cracking, and may even be folded by lateral pressure.

(5) In course of time salt-water ice undergoes a slow metamorphosis owing to temperature variations, whereby the salt it contains is diminished in quantity. Old sea-ice therefore approaches in its properties more and more to fresh-water ice.

(6) The formation and melting of ice in the sea are links in a thermodynamic cycle whereby heat is transformed into work. In the sea the process is confined to the localities where the paths of the ice-bearing Polar stream and the Gulf stream cross one another, particularly the regions between Iceland and Jan Mayen, and south of Newfoundland. Between these tracts and the highest latitudes of the Polar sea, where

the sea-water freezes, there is a continual transport by means of currents of latent heat and potential energy.

The purely mechanical process whereby the melting of ice develops energy may be demonstrated in a very simple manner. It is necessary to make certain assumptions which have been chosen by Professor Pettersson so as to accord as closely as possible with the actual conditions. It is assumed that the drift-ice floats in Atlantic water which has a salinity of $35^{\circ}/_{\circ\circ}$ and a temperature of 1° C., and that the temperature at the surface of contact, that is, the melting point is −1·6° C. It may further be taken that the ice is similar in character to that examined by Professor Pettersson in the Baltic, containing $0{\cdot}14^{\circ}/_{\circ\circ}$ of salt. If the thickness of the ice be l mètres, the depth below the surface in water of $35^{\circ}/_{\circ\circ}$ salinity, and at a temperature of 1° C., will be $0{\cdot}1185\ l$. Consider now a column of ice at the edge of the pack with a cross section in the form of a parallelogram of one square mètre in area, and suppose this column enclosed in a case of thin metal wherein the water produced by melting may collect. Then after melting the water within the case will stand $0{\cdot}0278\ l$ mètres above the surface of the sea, and if the upper part of the case be removed, will flow away as a surface current, mixing with the surrounding salt water. If the bottom of the case be then removed, the hydrostatic pressure will force in the salt water below, which will raise the water from the melting of the ice still more, and increase the strength of the surface current. If, as soon as the outer mètre of the pack edge is melted, we imagine the metal case to be again thrust one mètre into the edge, we can gain some idea of the continuous process going on along the pack, which is at least 190 miles broad between Jan Mayen and Iceland.

Mechanical work is performed both by the fall of the water that stands above the mean sea-level, and by the raising of the water from the melted ice to the surface. Referring the specific gravity to that of pure water at 4° C., Professor Pettersson calculates the work performed in producing a current as $0{\cdot}01391\ l$ mètre-kilogrammes for each kilogramme of melted ice. The value of l varies considerably, icebergs and hummocks sinking far deeper than ten mètres into the water, while ice-floes are comparatively shallow. Perhaps seven to ten mètres may be the average, but for this calculation ten mètres may be taken, as the energy developed by ice melting is liable to be underestimated with the assumptions given above, for the ice melts not only at the edges, but much more on the under side, the work performed by the raising of the water above the general level vanishing in this case, but that due to the upthrust from below being doubled. With ten mètres as the value of l, the mechanical work is then 0·1391 mètre-kilogrammes for each kilogramme of melted ice.

The next question to be considered is how much of the pack edge between Jan Mayen and Iceland must be melted in order to produce a surface current of the dimensions of the actual east Iceland current. The vertical section of the stream, enclosed in the isohaline of $34^{\circ}/_{\circ\circ}$, between Langenäs in Iceland and lat. 66° 23′ N., long. 7° 25′ W., has an area of 43,574,000 square mètres. As a measure of the velocity the drift of a

float belonging to the *Ingolf* expedition may be taken. This float travelled from 67° 17′ N. lat., 9° 20′ W. long., to Stromö in the Färoes, a distance of 320 miles in eighty-two days, indicating a velocity of 0·084 mètres per second. Consequently the volume of water which passes through the vertical section in a second is 3,660,000 cubic mètres, which is equivalent to 3,760,000,000 kilogrammes, if 1·0265 be the mean density of the water in the Polar stream. Of this water about one-eighteenth is melted from ice, and the remainder is Atlantic water, so that in every second 208,890,000 kilogrammes of ice must be melted from the pack edge, or 696 kilogrammes from each of the 300,000 mètres of its edge. This would yield 96·8 (696 × 0·1391) mètre-kilogrammes, or 1·29 horse-power per mètre. Along the whole edge would therefore be developed 400,000 horse-power, used up exclusively in the maintenance of the current.

The melting of ice is then to be regarded as one of the sources of energy of the Polar stream. This stream arises through the passing upwards of Atlantic water which, mixing with about one-eighteenth of melted ice, flows away from the surface. It may be compared with a waterfall, only that it flows from below upwards and the energy of the rising water is entirely applied to the formation of a current.

The melting of the ice demands 77 × 696, or 53,592, units of heat. This, of course, is supplied by the Atlantic water and amounts, since the temperature falls from 1° C. to −1·6° C., to 2·6 units of heat per unit of weight, that is, 20,612 kilogrammes of water must be carried north by the under-current to melt 696 kilogrammes of ice along each mètre of the pack edge. Of this quantity 17 × 696, or 11,832, kilogrammes help to form the Polar stream, of which seventeen-eighteenths are Atlantic water, while the remaining 8780 kilogrammes are cooled below −1° C. by contact with the ice, sink down and form the cold bottom layer on the Norwegian Sea, which has a temperature of −1·3° C. and a salinity of 34·9 to 35°/₀₀.

Naturally the velocity of the water both in the Polar current and in the under-current varies from layer to layer. The movement is constant, and the depth of the Polar current is 200 mètres; the two currents flow in opposite directions, and the cold bottom layer forms the limit of current movement. Accordingly the mean velocity may be calculated as about 6·9 cm. for the Polar current, and 2·9 cm. per second for the Atlantic water. But the actual rate will be more closely obtained if the drift of the float above-mentioned be accepted as an indication, from which the movement of the Polar stream is seen to be about 4 miles a day, and that of the under-current 1 mile. The Polar stream, however, carries along with it a certain quantity of water from the under-current, and this is the layer of 34 to 35°/₀₀ salinity, which Professor Pettersson calls West Atlantic water.

The energy produced by the ice-melting is applied to the maintenance of the current movements and to overcoming resistance (friction, vortex movements, etc.). If $\frac{mv^2}{2}$ and $\frac{m_1v_1^2}{2}$ be the *vis viva* of the mass of water which a second passes through a vertical section of the Polar stream, and the under-current respectively, the total work done by the current movement

is $\frac{mv^2}{2}+\frac{m_1v_1^2}{2}$, which with the above data reduces to 15,000 to 20,000 horse-power. As the whole available work is about 400,000 horse-power, it is evident that only a small part is needed to maintain the movement when it is in full swing, and that the rest of the energy is spent in overcoming resistance.

The lowest ice-cold bottom water flows to the east side of the Norwegian sea, filling up its deep basin to the crests of the Iceland-Färoe and Wyville Thomson ridges. Its level stands considerably higher at the south-eastern limit of the Norwegian sea than in the Jan Mayen channel. The reason of this phenomenon is twofold. In the first place the Gulf-stream water flowing over the Wyville Thomson ridge reacts on the bottom water, and secondly a hydrostatic pressure seems to exist in the Jan Mayen channel, driving the bottom layer from west to east, as appears from the gas analyses made by the *Ingolf* expedition. This movement of the bottom water also reveals itself by its driving up against the northern slope of the North Sea plateau and the northern side of the Färoe-Iceland bank.

On this bank the Gulf stream and the Polar current meet, and, considering the densities of the different layers, it is easy to see that the greater pressure in the deeper parts is exercised by the Polar current, which therefore forces its way under the Gulf-stream water, and, mixed with it, flows over the threshold into the depths of the North Atlantic. Such were the conditions in the summer of 1896. In the winter of 1896 and in the succeeding winter the Polar current found also another outlet, namely, over the surface north of the Färoes to the mouth of the Norwegian deep channel, as was proved by the drift of a float dropped from the *Ingolf*. Proof of an inflow of Arctic water into the Kattegat and Baltic was obtained by the Swedish hydrographers in 1893 and 1894, and the way in which this water crosses the Gulf stream was explained in the *S.G.M.*, vol. xiv. p. 467.

The circulation in the North Atlantic is so arranged that the Atlantic water is drawn to the northern and western parts of the ocean, and even under the ice mantle of the Polar basin and the frozen sea of Greenland, along the deep troughs and hollows of the ocean bed, and melts the Polar ice, thus giving origin to a powerful surface current and a bottom layer of cold water which fills the depths of the Arctic seas to the level of the banks. The east Iceland Polar current sets against these banks, where it meets the Gulf stream and finds an outlet for part of its water over the Färoe-Iceland bank under the Gulf-stream water, while the other skirts the northern side of the bank and meets the Gulf stream again to the north of the Färoes and, in summer as an under-current, in winter as a surface stream, reaches the Norwegian channel and the North Sea plateau, extending its farthest branches to the west of the North Sea and into the Skagerack and Kattegat.

Of other branches of these currents may be mentioned the offshoot of the Gulf stream found by the Norwegian expedition of 1898 on the western side of the coast bank of Spitzbergen. Again, the important discovery by the *Hekla* expedition of 1891 of a lower layer of water, warmer and salter than the surrounding sea, was explained by Professor Pettersson

and Dr. G. Ekman by the theory that an arm of the Gulf stream flows as an under-current at about 74° N. lat. against the Greenland coast.

That also into Davis' strait and even into Baffin's bay an under-current of warm and salt Atlantic water finds its way is abundantly proved by the observations of the *Ingolf* expedition. To the same expedition we owe the discovery that the Irminger stream divides itself south of the Denmark strait into two arms, one of which turns south-westwards accompanying the Polar stream, while the other passes through the strait between Greenland and Iceland and then dips under the Polar stream. Naturally this warm under-layer contributes to the melting of the ice, but probably its principal work is the formation of the Iceland coast stream, while the enormous melting of the ice in the Jan Mayen channel is due chiefly to the more voluminous current from the Norwegian sea. This view is opposed to that of the physicists of the *Ingolf*, who maintain that the under-layer of the east Iceland Polar stream comes from the Irminger current, pointing out that its temperature falls from north to south. This, however, does not affect the present theory, since it is not supposed that the under-current flows from south to north, but from east to west, following the deepest part of the Jan Mayen channel. The temperatures observed by the *Ingolf* expedition were higher towards the east, in the most eastern station rising to as much as 2·3° C., and this relatively high temperature was accompanied by a high salinity, which is quite natural if the water comes from the Gulf-stream area of the Norwegian sea.

The motive power which keeps this under-current in motion is not a direct transformation of latent heat into work, but is a link in a thermo-dynamic cycle, by which the potential energy previously stored up in the ice is set free.

Ice-melting plays a very important part also in the sea east and south of Newfoundland. Here also a surface current is formed and a cold bottom layer, the Polar current sinking below the Gulf stream. It is at the edge of the Antarctic pack that ice-melting exhibits its power on the largest scale. Thence proceed the cold surface currents of the Indian, Atlantic, and Pacific oceans. The hydrographic conditions near the ice edge are the same in the Antarctic as in the Arctic seas. In both cases a deep warm layer lies below the water of melted ice (−1·67° C.).

The circulation, as here described, is not constant, but is subject to periodical and also irregular variations. In some years the east Iceland Polar stream is not free from ice, but large masses drift past the east coast of Iceland. It would be interesting to observe the conditions of the Irminger and other branches of the Gulf stream in such years.

GEOGRAPHICAL NOTES.

By The Acting Editor.

EUROPE.

Russian Explorers.—We are indebted to Mr. E. Delmar Morgan for the following note :—

The *Report* of the Russian Geogr. Soc. for 1898 contains the death-roll of its members. Among those whose merits earned for them a conspicuous place in the annals of the Society, and who became more widely known in Europe, is Admiral Vassili Stepanovich Zavoiko, elected a member in 1852. He took part as a midshipman in the sea-fight of Navarino, circumnavigated the globe twice between 1835 and 1838, and then, entering the service of the Russo-American Co., was appointed manager of its factory at Okhotsk in 1840. He advised the removal of the factory to the more convenient port of Ayansk, and was chiefly instrumental in turning the attention of the Russian Government to the Amur region. By his initiative an expedition was equipped to survey the mouths of this river, resulting in the final union of the maritime districts with Russia. But Zavoiko's most memorable actions were concerned with the war in the East. He successfully defended Petropavlovsk from an attack of the Anglo-French fleet from the 17th to 24th August 1854. In the very hottest time of the hostilities he removed the naval and military stores from Petropavlovsk to the mouth of the Amur, and with a small squadron consisting of one frigate, one corvette, three transports, and a large boat set sail for De Castries bay, which he entered on the 8th May 1855. The following day he was observed by the enemy's squadron, consisting of three warships. These, however, waited for reinforcements before attacking, and that night Admiral Zavoiko, favoured by a light fog, slipped out unperceived and made good his escape to the mouth of the Amur.

After the conclusion of the war Zavoiko built the town of Nikolaievsk on the bank of the Amur in ten weeks. These eminent services were recognised by his appointment to a high administrative post in the Ministry of Marine. He continued to hold this appointment till 1874, when he retired to his estate in Podolia, where he ended his long and useful life at the age of eighty-nine.

Nikolai Ivanovitch Raievsky, though trained in natural science, was better known for his educational work. While Chief Inspector of Schools in Irkutsk he was elected President of the East Siberian branch of the Geographical Society, and from 1883 to 1887 infused new vigour into its work. He commenced a course of public lectures, since continued, and was engaged in founding a botanical garden at Irkutsk when he was summoned away to other spheres of usefulness. Raievsky attended nearly all the international geographical congresses, and was the author of text-books still in general use in Russian middle-class schools.

In Nikolai Danilovich Jürgens the Society has lost one of its most valued colleagues. Jürgens began his career in 1868, by passing a brilliant examination in pilotage at the Naval College where he was trained ; for many years he filled the post of chief pilot of the navy, and gained a wide experience in the course of many voyages over sea and ocean, but especially in the Pacific. From 1881 Jürgens became known in Europe in connection with Polar research, having been appointed chief of the Ust-Lena expedition. It was on this occasion that he showed singular devotion to his duties in establishing a meteorological and magnetic observatory in the delta of the Lena and in conducting observations there from the 1st September 1882 to

the 1st July 1884. With terrible loss of energy and strength he faced the rigours of the Arctic winter, the darkness of the Polar day, and frosts of −52° Celsius (−62° Fahr.). Upwards of a million readings of instruments were recorded by him and his associates, and it is worthy of note that in 15,000 hours of observation not a single hiatus occurs. For these services to science the Russian Geographical Society awarded Jürgens their gold Constantine medal. After rendering an account of his work to the naval authorities in 1887 Jürgens once more returned to the Pacific on the cruiser *Admiral Nakhimof*, but in 1890 his health giving way he was obliged to accept less arduous duties, and entered the Treasury in the bank-note department. Here he worked on till his death at the early age of fifty. He had many friends and admirers, and his counsel was always greatly valued.

Among the less distinguished names are those of Gustav Ivanovich Sievers, naturalist and explorer of Transcaspia, Armenia and the Caucasus, and Mikhail Pavlovich Khoroshkin, who passed ten years of military service in Turkestan and the Transcaspian province, and contributed some papers on these countries to geographical literature. Last, but not least in merit, comes the name of Mikhail Grigorievich Chernaief, the illustrious conqueror of Tashkent, who opened to science a vast field of inquiry sufficient to last Russian geographers for a generation or two.

Amorgos is the most eastern of the Cyclades. The small town of the same name lies exactly 36° 50′ N. lat. and 25° 55′ E. long., and is 40 miles from Naxos and from Ios. The island is long, measuring from Cape Palos in the south to a point at the extreme north-east between the capes Limenari and Xodotos, about 20 miles, while its breadth varies from two-thirds of a mile to 2¼. Different values have been given for its area, the mean being about 50 sq. miles. The western coast sends out several promontories between the capes Palos and Limenari, while, on the eastern, besides Xodotos, there is only the promontory of Movros. Naturally, on the former coast, the bays are numerous, and though violent winds blow frequently through the narrow channels separating Amorgos from the islands of Nicovria, Petalida, and Grembusa, boats can find shelter in the bays of Vlykada and Giali on the north, of Katapola, which serves as a port for the town of Amorgos, and elsewhere, but on the long eastern coast the small roadstead of Sparti, in the bay of Halara, is the only refuge. Consequently, the island was for a long time isolated, and the hardy pirates who knew every mile of the coast lived there, without molestation, on the proceeds of their robberies. The chief port is Katapola, a long, narrow, natural harbour, where the largest vessels can anchor. It is a mile in breadth, and has depths of from two to five-and-twenty fathoms. At Katapola, on the south, built on the ruins of the ancient town of Minoa, is a small stone quay.

All the Cyclades are mountainous, but, considering its small breadth, Amorgos is the most elevated. Three principal mountains stand along its axis; on the north-east, Mt. Krikelas, rising to 2798 feet; in the centre, the Prophet Elias, 2378 feet; and at the south, Asprovouno, 2067 feet. Of these Krikelas is the steepest and least accessible, with spurs stopping short at the sea on the north and east in precipitous cliffs. Up to 1835 it was covered with a dense forest of old oaks, holm oaks, and cypress, but in that year a terrible fire destroyed all the trees, and now the mountain is bare. The Prophet Elias, crowned by a chapel, also presents a most desolate aspect. The three summits are connected by hills or plateaus more or less elevated, which are in general well cultivated.

The island is formed of sedimentary rocks, Palæozoic schists, and sandstones, on which have been deposited deep limestone strata, probably in the Cretaceous

period. These strata are folded, and stretch parallel to the longitudinal axis of the island, first eastwards and then north-westwards. The same rocks occur on Santorin, and a zone of folded mountains seems to skirt the Cyclades on the south-eastern side, and probably extends to Kikaria and Khios, where very similar rocks are known to exist. Katavothra are scattered over the island, but many are filled up, lest animals should fall into them.

The chief valley is that of Kolophana, situated at the southern extremity of the island, at the foot of Asprovouno. From Kolophana to Amorgos extends a long narrow plateau, which bears different names; it is the most carefully cultivated part of the island, and is planted with numerous fruit-trees. The pleasantest valley, however, is that on the shores of the bay of Katapola. As the isle consists of small conical hills and low plateaus, running water is rare. Formerly, it is said, streams were abundant, and the ruins of water-mills seem to confirm this statement. Probably the present drought is due to the complete destruction of the forests, chiefly owing to the thoughtlessness of the inhabitants. The Greek Government has endeavoured to check the destruction, but it is difficult to make the law respected in the remote recesses of the archipelago. To remedy this want of water, pits and cisterns have been digged to collect the rain, these being generally nothing but simple ditches.

The climate is healthy, and much the same as in the other Cyclades and the Sporades. There are no endemic diseases, and rheumatism, common in the group, does not trouble the old people of Amorgos, whose custom it is to wear flannel. The products of Amorgos are barley, wheat, cotton, wine, figs, vegetables, especially pease, and a little tobacco. The vines, though few, are of many kinds, and yield excellent wine. The old custom of keeping the wine in dried goat-skins with the wool inside, which gave it a by no means pleasant flavour, has gone out. The oil also is excellent, though the olive is very small. It is still extracted by the ancient method of pressing the olives in a bag between two flat stones. The *katsouni*, a kind of chickpea, forms the principal food of the islanders, and is preserved with great care. Before storing them, the villagers rub the peas with their hands dipped in oil. Lentils and other dried vegetables are protected in the same manner from the attacks of insects. Most of the cultivated land belong to the monastery of Khozoviotissa. The peasant prefers to till the lands of the monks, as he gains more money than by cultivating land for himself. Usury is a great hindrance to agricultural progress. A peculiar product of the island is a lichen growing in greyish tufts of very fine leaves, which is used for dyeing. The plant grows on other islands, but is used only on Amorgos.

Domestic animals are not numerous. A few mules and horses, and rather more than 2000 sheep and 3000 goats, are owned by the inhabitants. A large number of wild goats are killed annually on the heights of Krikelas. The industries are very primitive; the women weave coarse cotton cloth, and plait straw hats.

A few years ago, the island of Amorgos and its small dependent islets contained 4058 inhabitants, or about one to $9\frac{1}{2}$ acres. They are all of Greek origin, or, at any rate, completely Hellenised. Both men and women are tall, well made, and robust. They are hospitable, but have had a bad reputation as thieves and plunderers. Their houses, with few exceptions, have only one story, and are wretched in appearance. In the sleeping-room, the bed is placed half-way between the floor and the ceiling, and is reached by mounting on to a long coffer used for storing corn, and then on to a stool. A second room is used as storeroom and kitchen.

The costume of the men is the same as in the other islands, and also the skirt

and bodice of the women. The headgear is peculiar, consisting of a cushion a foot high at least, placed on the top of the head, and covered with a long black handkerchief, intertwined with another of a yellow colour. At the back of the head is another cushion, also kept in place by the black handkerchief, which hangs down to the middle of the back, and is so arranged that no part of the face is seen except the nose and mouth. The young women wear a veil over the face when at work, to preserve their complexions.

Many details on the history, folklore, and antiquities, etc., of Amorgos, are also given by M. Hauttecœur, in the *Bull. de la Soc. R. Belge de Géographie*, Nos. 1 and 2, 1899.

ASIA.

Railway Communication with India.—Mr. Thomas Gibson, F.R.S.G.S., writes to us on this subject as follows :—

"It must be a matter of considerable surprise to travellers of all nations and in all parts of the world to notice the apathy with which the British public treats the subject of railway extension to India. True, in the House of Commons a member from time to time ventures a question to the Government, but he appears to be quite prepared for the invariable rebuff that the subject is delicate ground unsuited for discussion.

"Russia, in the meantime, is throwing out iron arms in all directions, and the possibility of connection with India over her system of railways is already so far advanced that the member for Cardiff lately drew the attention of the House to it with but little satisfaction to himself or to any one else. It would almost appear, indeed, as if Great Britain were as indifferent to what this means in relation to her immense responsibilities in the East as when she scoffed at Lesseps at work on the Suez Canal. No wonder that the inhabitants of Quetta have declared that, if Britain will not extend a direct railway to them, they will be forced to undertake the work themselves.

"There is, however, some prospect now of a closer interest being attracted to the importance of British creation and control of railway extension to the East. The contractors of the Cape Central Railway are reported to have undertaken the construction of a line from Haifa to Damascus, from which city it is proposed to extend it afterwards to Bagdad. There then would remain but the gap between Bagdad and Chaman, the present terminus of our railway from India through Quetta —a gap of less than 1400 miles as the crow flies. Granted that the closing of this gap represents more weighty difficulties than those associated with finance and engineering, surely our associations with Persia and Afghanistan are now such as to ensure favourable concessions, provided our Government will only make firm application for them. At Haifa it is intended to erect a breakwater, and this port will be the present European terminus of the railway. But without any doubt Bagdad will one day be coupled on to Scutari by a railway running along the valley of either the Euphrates or the Tigris. Then we should have a through route from Calais to Calcutta *viâ* Paris, Constantinople, Bagdad, and Quetta. A direct railway, in fact, which might be said to have the bulk of Europe at one end, and some 800 millions of people at the other! For it must be remembered that in addition to the traffic of our own vast Colonial Empire as represented by India, Australia, etc., such a railway would eventually tap part of China, Japan, the French possessions, Siam, and the Far East generally. Is Britain, then, going to stand idly aloof and see the control of this great overland highway pass into the hands of another nation as she did the waterway at Suez? It would almost appear so.

"The capital cost involved should not prove ground for objection. The Cape to Cairo railway is likely to be *un fait accompli* within a reasonable time. A tunnel to Ireland would appear to be accepted as within the sphere of practical politics, although its cost would probably absorb a sum nearly sufficient to construct the 1400 mile gap to which I have alluded. But of how much greater importance is it that the strength of the Government should be pledged to stretch out an iron arm to the hundreds of millions of our fellow-subjects in the East!

"Our vast Australian empire is also interested in the railway. Nature has made a causeway for it in the long Malay peninsula and the two long islands of Sumatra and Java, so that a land route might be continued, with a few comparatively short interruptions, to the north-western part of Australia, diminishing the tortures of sea-sickness for those of our countrymen who desire to see the countries and peoples of the East."

We hope that this Society may be able shortly to further the enterprise our correspondent has at heart by setting before its members the various aspects of the problem and the proposals that have been made by different authorities, with their respective advantages and disadvantages. In the meantime we may draw attention to a project which, if realised, will considerably shorten the journey to India. Several months ago a British syndicate made overtures to the Turkish Government for the construction of a railway from Konieh, now the terminus of the Anatolian railway system, through Adana to Aleppo (with a branch to Alexandretta), thence to the Euphrates and along the river through Hit to Bagdad, whence it would be continued through Basra to a suitable point on the Persian Gulf between Fao and Koweit. With a service of fast steamers to Karachi or Bombay, the journey to India would, says a correspondent to the *Pall Mall Gazette*, July 1, be shortened by five or six days. The journey from London to Constantinople would take 72 hours; from Constantinople to Konieh, 20 hours; from Konieh to the Persian Gulf, 35 hours; and from the Persian Gulf to Karachi, 50 hours. Hence we get a total of 177 hours, or about 7½ days as against 13 days by the present route. There would be only two breaks, one at Dover and the other at Constantinople, where passengers would have to cross to Haidar Pasha, a distance now traversed by small Turkish steamers in a quarter of an hour. The railway would greatly benefit the Turkish Empire by opening up the rich valleys of the Euphrates and Tigris, where, with proper irrigation, an enormous quantity of corn could be grown.

Negotiations have been going on for some time between the British capitalists and the Ottoman Government, and had nearly reached a satisfactory conclusion, when the Germans protested strongly against the granting of a concession. The Angora railway, 302 miles in length, was completed by a German company in 1892, and then the company immediately applied for leave to make a branch from Eskishehir, half-way between Haidar Pasha and Angora, to Konieh. This was granted on condition that the company extended their line from Angora to Kaisarieh within eight years from 1893, and that the Ottoman Government should have the right to call upon the company to construct a line from Kaisarieh through Diarbekr and Mossul to Bagdad. Up till now no attempt has been made to fulfil the former of these conditions, and the company is evidently anxious to abandon the Diarbekr and Mossul route, as there are many engineering difficulties in the way, and the vilayets through which it passes do not yield revenue enough to cover the Government guarantee. Consequently they wish to compete with the British syndicate for the line through Adana and Aleppo. The Sultan is said to show a marked preference for the British proposals, which are far more favourable to the Turkish Government than those of the Anatolian Railway Company.

Areas of the British and French Possessions in India and Farther India.—Dr. H. Wagner has calculated these areas, bringing them, to avoid errors, into harmony with the figures given in the *Bevölkerung der Erde* (viii., 1891), since when several changes have taken place in the political distribution of the territories of Asia. In that work B. Trognitz gives the following areas:—India, 1,412,808 sq. miles of mainland, and 243 in islands, making together 1,413,051; Farther India, 817,082 sq. miles on the mainland, and 3919 in islands, or 821,001 together. In the west, Baluchistan, British Baluchistan, the Afghan-India boundary region, and Kafiristan were excluded; while since 1891 several changes have taken place in Farther India, in consequence of which Yunnan has been enlarged by about 13,500 sq. miles.

In Farther India the main difficulty lies in the definition of Siam. The territory left nominally to this kingdom by the Anglo-French treaty of 1896 has an area of about 231,600 sq. miles. But the country between the Mekong and the watershed of the Menam was recognised as a sphere of influence of France, while Great Britain acquired similar rights over a strip of territory east of the Salwin, and in the Malay peninsula as far as Muong Bang Tapan (11° 15′ N. lat.). If these be abstracted, the remainder left to Siam is only about 92,700 sq. miles. In the former case the area of the British possessions will be 303,600 sq. miles, and of the French 272,200, making, with Siam, 807,400 sq. miles. In the latter case the British possessions have an area of 351,800 sq. miles, and the French of 362,900. The population of Upper Burma and the neighbouring territories is 3,900,000, giving a density of fully 23·3 to the square mile, while Lower Burma has 4,658,000 inhabitants, or nearly 52 to the square mile. The French possessions and sphere of influence contain 22,400,000 inhabitants, being a ratio of fully 62 to the square mile.—*Petermanns Mitt.*, Bd. 45, Heft 6.

Karabugas Bay.—M. Nicolas de Seidlitz describes in *Globus*, Bd. lxxvi. No. 1, some of the results of recent research in this enclosed bay. Little was known of it until M. N. J. Andrussof was sent out by the Ministry of Agriculture in 1894. Having lost his instruments in the Caspian, M. Andrussof was obliged to confine his work to geological observations between Krasnovodsk and Karabugas, but he left the mate Maximovich behind to pass the winter in the bay, take meteorological observations, and to note the density of the water and the velocity of the current in the Karabugas strait.

Great changes were found to have taken place since Admiral Ivashintsef examined the strait in 1864. In the middle of the channel, where the latter found a bank with a minimum depth of two feet, islands, covered with grass, and even brushwood, rise half a foot above the water. The current runs, both on the surface and below, from the Caspian Sea into the Karabugas bay, and a counter current, which might arise in winter during east and north-east winds, does not exist. The mean velocity is three miles an hour on the surface, increasing to five miles in narrow and deep parts. Bubbles of sulphuretted hydrogen frequently rise from the bottom. In very severe winters the strait is frozen over entirely, but usually it is covered only near the banks with ice which begins to form at a temperature of 23° F., and attains a thickness of five inches. In autumn and winter easterly winds prevail with a temperature 20° to 18°; in spring, from the north-western quadrant of the compass, with dull and sometimes rainy weather; and in summer, light winds from the south-eastern quadrant. Maximovich found that in December 1895 the temperature in the water of the strait ranged from 55½° to 29¼°, while 57° to 17·6° was recorded in the air. The water is therefore

on the whole warmer than the air, while in summer, according to the observations of Admiral Philippof, the reverse is the case.

All travellers who have visited the Karabugas report that the fishes which enter the bay very soon perish, being first blinded by the salt water and then cast ashore dead, where they are found by the Turkomans in the same state as artificially cured fish, and are collected for food. They generally enter the Karabugas in shoals early in the year and in late autumn—in summer only in individuals. From the beginning of November till the middle of February not one enters, probably because the water temperature then sinks below 57°, and the small crustaceæ vanish from the shores. The enormous quantity of organisms carried into the Karabugas, from the smallest pelagic forms (plankton) to the largest fishes and seals, may, in Dr. Andrussof's opinion, lead to the accumulation of abundant material for the formation of petroleum.

The expedition of Andrussof and Maximovich not having obtained all the information desired, the Ministry of Agriculture and Crown Lands sent out a much larger expedition in 1896, and at the same time the Committee of Caspian Fisheries memorialised the Ministry to set up a copper network in the strait to keep the fish out of the dangerous bay, afterwards to be replaced by a dam with a lock. The expedition decided that there was no persistent sinking of the level of the water in the Caspian Sea, and that at any rate it was not caused by the excessive evaporation in the Karabugas. The damming up of the strait might cause a rise in the level of the water: but in view of the greater evaporation over the enlarged surface of the Caspian, it could not practically benefit navigation. As regards the fish, the erection of fishing stations in the strait was recommended. An open waterway between the Karabugas and the Caspian was shown to be very advantageous from a commercial point of view, for in the centre of the basin, over an area of some 1300 square miles, a deep layer of Glauber's salt has collected, which might be easily worked, as the depth is not more than seven fathoms. It is estimated to contain over a thousand million tons of dry salt.

Owing to rapid evaporation, the water in the basin is very dense, and much denser in the lower strata than on the surface, though the depth is insignificant—from five to seven fathoms. The fresh Caspian water is only perceptible at a short distance from the strait, while in the middle of the bay the salinity is not affected. The specific weight of the water on the surface is almost always 1·1400 at 17·5° C., and rises at the bottom to 1·1850 and more. Now the proportion of common salt to magnesium sulphate in the Black Sea is 11 : 1, and when the water is concentrated to the same degree as in the Karabugas bay, salt is precipitated, and only in very favourable conditions of temperature can Glauber's salt be formed from the residue. But in the Caspian water the proportion is only 2 : 1, and in the Karabugas there are 12·8 per cent. of common salt to 5·03 of magnesium sulphate. The salt is therefore far less than is required to saturate the water, while the amount of Glauber's salt produced by chemical action between the common salt and magnesium sulphate is more than the water can hold in solution, and is consequently precipitated.

AFRICA.

Report on the Sudan.—Sir W. Garstin's report on the hydrography and agriculture of the Sudan treats of the Nile between Abu Hamed and Khartum, the Blue Nile and the White Nile. Abu Hamed is 230 miles from Wadi Halfa, and Berber is 127 miles farther up the river. In the latter stretch the desert is broken by numerous ravines studded with acacias and dum palms; the inhabitants

are few, and cultivation exists only in small patches. Berber (lat. 18° 1′ N.) is a large straggling town on the east bank of the river, with an immense flat plain in the rear, much of which might be irrigated. Between Berber and the Atbara the inhabitants are fairly numerous, and a broad band of cultivated land skirts the east bank of the river. The Atbara at its junction with the Nile has a bed fully 400 yards broad, and, though dry in summer, rises in the rainy season 26 feet above its bed, entering the Nile with great force.

From the Atbara to Khartum the distance by water is about 260 miles. The Shabluka cataract begins about 35 miles from Khartum, and has a length of 52 miles. The average slope of the river bed is 1 in 11,000 from Khartum to the cataract, 1 in 5500 in the cataract and rapids, and 1 in 12,500 thence to the Atbara. This tract has a most desolate appearance; there are few people or cattle, and little cultivation, much of the soil, though good, being covered with halfa grass which could only be removed with a great amount of labour. Shendy and Metemmeh are in ruins and practically deserted.

Omdurman is distant 209 sq. miles from the Atbara; it covers an area about 5½ miles long by 1 to 1½ broad, and, with the exception of one or two broad streets, consists of winding lanes. The low tongue of land between the Blue and White Niles, on which Khartum was built, is 5 miles up-stream. The town (lat. 15° 36′ 38″ N.) was completely destroyed, but its reconstruction is proceeding rapidly. Towards the Blue Nile the frontage is excellent, but it is feared that in the lower parts of the town the subsoil water may approach so near to the surface as to produce malarial fever.

The Blue Nile from the lowest cataracts at Rosaires to Khartum has a length of 426 miles, with a slope between Rosaires and Sennaar of 1 in 5000, and between Sennaar and Khartum of 1 in 1770. The difference between flood and summer level is 20 to 23 feet, and in the first quarter of the year the river is reduced to a succession of deep pools connected by very shallow reaches. The maximum height is reached in August. For a few miles above Khartum the cultivation on both sides of the river is good. At Soba, on the east bank, 18 miles from Khartum, the cultivation is scattered, and from this point the character of the country is the same for many miles. The eastern bank is covered with thick but low thorn jungle, and the west bank is covered with halfa grass. Heavy crops of durra, lubia, sesame, and vegetables are grown along the foreshore. Rufaa (116 miles), on the east bank, is said to be the second largest town on the Blue Nile. Its inhabitants are a branch of the Shukriyeh tribe of Arabs. Above Abu Haraz (140 miles) both banks are clothed with dense jungle. About half a mile farther the Rahad enters the Blue Nile on the east, and brings down a large volume of water when in flood. Its banks also are covered with dense jungle. The Nile is here 490 yards broad. On the west bank, 147 miles from Khartum, stands Wad Medani, the largest and most important town on the Blue Nile. Its population, 15,000 to 25,000 in number, is a mixture of several tribes. It is the healthiest in the Gezireh, probably because it is built on a high ridge composed of sand and gravel. The plain of alluvial soil around is covered with durra in the rainy season, and the cultivation on the foreshore is good of its kind. Grain of many kinds is exposed for sale in the market, and Manchester and other European goods find ready sale.

The forest on both sides of the river is chiefly composed of acacia of several varieties, mimosa, tamarisk, baobab and *nabbak* (*Rhamnus lotus*). On the western bank the forest belt is not more than 2 or 3 miles wide, and ceases altogether at Sennaar; but on the east bank it occupies large areas, extending even to the Gedaref plains. The soil is everywhere of the richest description, being the alluvium brought

down by the river. Durra is the chief crop, and is sown at the commencement of the rainy season. When rain is scanty in one locality, the people migrate to another where it is more plentiful, and plant their durra, paying a small tax to the owners of the land. Other crops are grown on the foreshore and irrigated.

The White Nile is totally different from the Blue, being sluggish, not subject to such variations in volume, and running between low banks. The slope between Lake No and Fashoda is 1 : 45,000, and between Fashoda and Khartum, 1 : 13,000, the total distance being 610 miles. The mean width of the river is 1800 yards, but in many places it is as much as two miles. For some distance above Khartum the banks are low, covered here and there with bush, and flooded when the water is high. Cultivation is restricted to the islands and foreshore, and the large mud flats which appear in the centre of the river as the water falls. Abba Island, 146 miles from Khartum, is 28 miles long, and very thickly wooded. The remains of the Mahdi's house are still visible. Above Gelebain, recognisable by the five peculiarly-shaped granite peaks rising abruptly from the plain on the eastern shore, the country is most dreary and monotonous. Fringes of forest on either hand mark the high ground, and between these the river winds through reedy islands, masses of swamp grass and floating weed. At 393 miles from Khartum is Khartum Kaka, a large Shilluk village, and from this point southwards the villages are continuous on the western bank. In front of them lies a broad belt of swamp varying in width from a few hundred yards to over a mile, and rendering landing quite impossible. Fashoda, lat. 9° 55′ 20″ N. and long. 32° 6′ E., is built on a small peninsula jutting out from the west bank at a distance of 467 miles from Khartum. It is a dreary spot, surrounded on three sides by a deep swamp, and very unhealthy. Even in March the air is damp and steamy, and the thermometer in the shade ranges at midday from 100° to 106°.

The Sobat joins the Nile 527 miles from Khartum in lat. 9° 22′ 8″ N., and long. 31° 31′ E. In March the depth was over twenty feet, but the current was feeble, being held back by the Nile ; but in flood the Sobat prevails over the Nile water, driving it towards the western bank. Large masses of sudd are brought down by this stream. Opposite the island of Tonga, a khor known as the Lolle enters the Nile from the west. It is supposed to be a river rising at a considerable distance, but it has not been explored. At Gapt-el-Magahid, 7½ miles from the Sobat, a large khor enters the Nile on the east bank. A few hundred yards up it widens out, forming a lake 1000 yards long by 500 wide, surrounded by forest. Above this khor the banks of the Nile are low, and the country consists of endless grass plains with nothing but large ant-hills to break the level.

The Bahr-es-Zeraf is in 1899 discharging more water than the Bahr-el-Jebel, probably because the latter is blocked with sudd. Above its mouth the Nile is split up into a labyrinth of channels. Tonga, the most southern of the Shilluk villages, is 573 miles from Khartum ; here the country of the Nuers commences. Lake No, known to the Arabs as Moghren-el-Bahur, or the "meeting of the rivers," is usually represented on maps as 2 to 3 miles broad by 3 to 4 broad, but it is practically impossible to fix its limits, as the whole country is a vast swamp. There is a fairly open expanse of water, 7 feet deep in the main channel, but broken up by large clumps of reeds and papyrus. The marshes extend on either side of the channel of the Bahr-el-Ghazal, which is about 40 yards wide and 8 feet deep at low water. On the south they are bounded by an immense grass plain, where the only sign of life is a small Nuer village. The sudd is reported to be blocking the Bahr-el-Jebel for a distance of 160 miles from Lake No.

The fertility and productiveness of the soil along the White Nile are not to be

compared with that in the basin of the Blue Nile, little organic matter being brought down by the former, and what is carried down from the upper reaches being filtered out by the vegetation through which the water passes. Durra, sown in the rainy season, is the chief crop.

The blocking of the river by sudd does not appear from the readings of the Nile gauges to have any appreciable effect on the height of the river in flood at Aswân and Cairo, but the marsh region undoubtedly diminishes the summer supply north of Lake No, and causes great loss by evaporation. The swamp area between Lake No and Shambe occupies an area of not less than one degree square, or 4701 sq. miles. The evaporation, in Upper Egypt 1·825 mètres per annum, may in the swamp region, where rain and cloud are constant during five months in the year, be only 1 mètre (fully 3¼ feet). This will give a loss of 429,990,000,000 cub. feet yearly, or about 1,178,000,000 cub. feet a day. It is equivalent to a river discharge of 13,630 cub. feet a second. The loss has been reckoned at considerably less, but it cannot be under 7060 cub. feet per second, which is half the amount of the mean summer discharge at Aswân. Mr. Willcocks has lately suggested that willows should be planted on either side of the Bahr-el-Jebel, and the river confined to one channel. Before forming any conclusions it would be necessary to make experiments with regard to the depth of water in which willows may be planted, and the cost of the operations. The willow is nowhere found south of Khartum.

Until the river is cleared from sudd it is impossible to examine the country and decide whether the swamps can be drained. Irrigation works on an extended scale might be advantageously undertaken on the Blue Nile and on the main river between Khartum and Berber.

The Upper Nile and Lake Rudolf.—The Parliamentary Report, Africa No. 4 (1899), consists of letters from Lieut.-Colonel Macdonald, Major Austin, and other officers, many of which contain information of a geographical nature. Captain Austin, proceeding last year to the Lake Rudolf country, marched for ten days along the Turquell River, and was then persuaded by the guides to take a short cut across the desert from the point where the river makes a great sweep towards the east. After much hardship from scarcity of water and forage, he came to the lake in lat. 3° 52′ N. Turkana possess large herds of donkeys and camels, and flocks of goats and sheep, but they had driven all their animals away into the hills, and hardly a single native was seen. Major Austin therefore hurried on to Murle on the Omo River, where he expected to find food plentiful. On September 7 the expedition passed into the Marle district, where the natives were friendly. On September 12 the party rounded the northern end of the lake and camped near the mouth of the Omo, a magnificent stream, 150 to 200 yards broad. Following the river, they reached Murle on September 15, and found that the Abyssinians had raided the country, cutting down the crops, and driving off many of the sheep and goats, so that the people were starving. They were therefore obliged to retreat immediately to Lumian, where a small quantity of grain was obtained, and then continued the march southwards, this time keeping to the lake shore as far as the Turquell River. On the return journey the Turkhana were more friendly, and Captain Austin made several treaties with their chiefs along the shore, and purchased a few sheep and goats. But along the river they became troublesome, and the expedition had one or two small encounters with them. At Ngabato he was met by Lieutenant Hanbury-Tracy with supplies. By a treaty with the Donjiro, whose territory extends north of the sixth parallel, Captain Austin extended British influence up to the Anglo-Italian boundary.

The geographical results of the whole expedition under Colonel Macdonald were summed up by him at a meeting of the Royal Geographical Society reported in the *Times* of June 21. The high and healthy plateau known farther south under the names of Mau, Nandi, and Guash Ngishu, was found to run far to the north, though at a reduced altitude. Immediately to the north of Mount Elgon it is encroached upon on the west by a swampy depression running out from the Nile which contains numerous lakes—Choga, Salisbury, Mpologama, etc. Northward of this, again, the plateau sends off numerous ranges in a north-westerly direction, the most prominent being the Nakwai, the Lobor-Agoro hills, the Nangiya-Kuron-Logire and Latuka ranges, and the Morongole-Harogo range. The western edge of the Karamojo plateau, as well as the above ranges, is well watered, but the plateau itself, though only 4000 to 5000 feet high, is healthy owing to its dryness. Mount Elgon and the western edge of the plateau seem to mark the eastern limit of the double rains, the plateau itself having only one rainy season—May to July. Farther north the same conditions prevail, and therefore the plateau can only be crossed in the rainy season, and consequently the expedition was unable to reach the reported gold-producing oases of Lali. Many of the mountains attain heights of 6000 to 10,000 feet, the loftiest standing as far north as the fourth parallel, namely, Agoro, Logire, and Harogo. Iron ore exists in considerable quantities, and gold was reported, but was not seen by the expedition. Elephants and other game are very abundant. The country seems to be the meeting-ground of Bantu, Negro, and Hamitic tribes, and is a rich field for the ethnologist.

Geology of the Cape of Good Hope.—Professor Corstorphine's report is accompanied by a map which shows that the survey commenced in 1896 has resulted in a considerable knowledge of the geology of the colony. With the exception of a few blanks over the south-western corner, it gives the geology of the area stretching from the west coast eastward to the Gamka River, and from the Zwartebergen on the north to some distance south of the Langebergen, while the Malmesbury District has been surveyed north to St. Helena Bay.

The area surveyed shows, in ascending order, the following formations:—(1) Malmesbury Beds — non-fossiliferous slates, phyllites, mica-schists and quartzites, with intrusive granite, quartz-porphyry, and diabase (marked unconformity); (2) Table Mountain Sandstone—sandstones and quartzites, with occasional shales; (3) Bokkeveld Beds—fossiliferous shales, sandstones, and greywackes; (4) Witteberg Beds—mainly quartzites, often with alga-like markings; (5) Dwyka Series—conglomerate and interbedded shales; (6) Ecca Beds—shales and sandstones, with occasional plant remains; (7) Superficial Deposits—gravels, sands, conglomerates, sandstones, and limestones. Throughout the area the only igneous rocks are those intrusive into the Malmesbury beds, granite being by far the most important. During the first year of the survey Mr. Schwarz, while working in the Worcester District, came across a peculiar juxtaposition of Malmesbury and Ecca beds pointing to the existence of a considerable fault, which has a marked effect over the area in question; and Mr. Rogers, in carrying on his work farther eastward, came to the conclusion that the Table Mountain sandstone not only forms the Langebergen, but reappears on the north to build up the main mass of the Zwartebergen. These two important observations have been fully confirmed during the past year.

AMERICA.

Dr. Steffen in Southern Chile.—On p. 322 Dr. Steffen was reported to have discovered a larger river, the Rio Baker. In a letter from Lago Cochrane (47°

16′ – 47° 20′ S. lat.), published in *Petermanns Mitt.*, Bd. 45, No. 5, he describes his subsequent movements. The Rio Baker is the largest stream south of the Palena, draining the whole region between lat. 46° 5′ and 47° 30′ S., and also the lakes Buenos Aires and Cochrane. Dr. Steffen ascended the river in boats for 44 miles in an east-north-easterly direction up to a waterfall, and then followed it on foot in a more northerly direction. Extensive swamps skirt both banks. The valley is broad, and shut in by lofty snowy mountains. At the foot of a transverse ridge the valley is joined by another extensive hollow running in a north-easterly direction, and containing a series of large and small lake basins. From the summit of the ridge Monte Cochrane was distinctly visible to the east, and as the Baker Valley, with its bamboo thickets and swamps, did not offer a convenient path, Dr. Steffen decided to follow the direction of the lakes. These he named Largo, Chacabuco, Juncal, and Esmeralda. The landscapes here are very picturesque. The bamboo thickets come to an end, and steppe-like stretches alternate with open woods of *rauli—Fagus Antarctica*. Huemules (*Cervus Chilensis*) were abundant. From the Cerro Ataud Dr. Steffen could descry the course of the Baker for some distance; it continues north-north-eastwards, and from its calm winding character it may safely be affirmed that it is the outlet of the Lago Buenos Aires and other lakes preceding it. The drainage stream of Lago Cochrane is also a majestic river, and after a short course unites with the Baker, being joined on its way by the Rio Salto, which rises in a glacier on Monte Cochrane.

Staaten Island.—This island is situated between 54° and 55° S. lat. at the southern extremity of South America. It is about 40 miles long from east to west, and is separated by the Lemaire Strait, 16 miles broad, from Tierra del Fuego. The island is mountainous, the highest summits rising from 2600 to 3000 feet above the sea. Forests of trees 40 feet high, and over a yard in diameter, cover the whole surface. Along the south coast runs a current with a temperature of 39° F., while on the north there is a current 11° warmer, and therefore the air is very moist, and the changes of weather sudden. In 1884 a lighthouse was erected on a promontory at the extreme north-west of the island at a height of 200 feet. There meteorological observations have been recorded for 1888 to 1893, and parts of other years. The climate is oceanic. The mean annual range of temperature is barely 11½°, and the absolute range is only 40·7°. Most rain falls at the end of summer and in autumn (August to November 27·3 inches), and a smaller quantity in spring (April to July, 15·8 inches). There are 251·5 days of rain and 67·5 of snow; even in summer it snows occasionally.—*Bull. de la Soc. R. Belge de Géographie*, No. 2, 1899.

OCEANS AND GENERAL.

The Temperature on the Surface and Floor of the Ocean.—An article on this subject by Sir John Murray, accompanied by two charts, is published in the *Geographical Journal* for July. All the temperatures recorded up to the present time indicate that from a depth of 100 fathoms downwards the temperature at any one place is constant, or nearly constant, throughout the year. In some special positions, and under some peculiar conditions, a lateral shifting of large bodies of water takes place on the floor of the ocean, which appears to be due in most instances to violent storms or strong off-shore winds bringing up colder water from considerable depths.

As regards temperature the floor of the ocean may be divided into two regions —a deep-water, where the temperature is nearly constant at any one spot throughout the year, and a shallow region, in which the sea-bed is subject to periodical or

occasional variations of temperature owing to changes in the overlying water. The former, occupying 93 per cent. of the whole ocean, and 66 per cent. of the whole surface of the earth, is entirely removed from the direct influence of the sun; all the sun's rays seem to be absorbed in passing through the 100 fathoms of water on the surface. Plant-life appears to be entirely absent from the deep region, and all the animals which abound in the depths of the sea are dependent for their food on organic matter which has been assimilated on the surface, and has been washed down from the surface of the continents and from the shallow waters. At the surface of the oceans the lines of equal temperature run more or less parallel to the Equator, though subject to deflections due to currents, whereas at the bottom they run on the whole north and south, following the general trend of the continents. The cold water, which occupies all the greater depths, is derived from the surface in extra-tropical regions, while the warmer water forms narrow bands along continental shores and round oceanic islands.

The darkest shade of blue on the map, indicating a temperature under 30° F., is limited to the ice-bound regions of the Polar oceans, but in the Norwegian Sea extends southwards to the Färoe Islands. In the enclosed area, north of the Wyville Thomson and Färoe-Iceland ridges, temperatures as low as 28·9° F. have been recorded in depths of 2000 fathoms. Water at temperatures between 30° and 35° covers nearly the whole bottom of the Antarctic and great southern oceans, extends through nearly the whole of the Indian Ocean, and sends offshoots into the Atlantic and Pacific. Water between 35° and 40° covers nearly the whole of the North Atlantic, and a very large part of the Pacific. The average temperature over the floor of the North Atlantic is about 2° F. higher than the average at the bottom of the Indian Ocean and South Atlantic, while the temperature of the bed of the Pacific is intermediate between these.

Of the warmer waters, that between 40° and 50° F. extends sometimes a considerable distance beyond the Tropics, running, for instance, along the coast of Norway. The next grade, between 50° and 60°, occupies a narrow strip off the shores in tropical and sub-tropical regions, and fills the Mediterranean; while water over 60° F. is confined to a mere line almost wholly within the Tropics, but it fills the Red Sea and occurs in part of the eastern Mediterranean. Around the islands between New Guinea and Paumotu a narrow strip of water at the bottom touches 70° F., and the same temperature is found in the Red Sea and one or two places in the West Indies.

Of the 127,100,000 sq. miles occupied by ocean water deeper than 100 fathoms, 122,700,000 sq. miles, or 96 per cent., are covered with water at a temperature below 40° F. Within the 100-fathom line there are 10,100,000 sq. miles of ocean, of which 3,960,000, or 39 per cent., are covered with water at a temperature below 40° F. Of the whole area of the ocean 92 per cent. is overlaid with water having a temperature below 40° F., and only 8 per cent. with water at a higher temperature.

The surface temperatures are next discussed, and first the minimum temperature. The coldest water, under 30°, lies in the Arctic and Antarctic regions, being confined in the southern ocean within lat. 50° S., while in the North-West Atlantic and North-West Pacific it reaches lat. 40° N. Water between 30° and 40° forms a band round the earth in the southern ocean, extends from the Yellow Sea, Alaska, and Bering Sea, and in a narrow belt from the east coast of the United States past Iceland, spreading out to Spitzbergen and Norway, and onwards to Novaia Zemlia. Water between 40° and 50° also forms a band round the southern ocean and crosses the North Pacific and North Atlantic, in the latter widening out enormously towards the shores of Europe. A band of water at a temperature

between 50° and 60° crosses the South Pacific, and broken only for a short distance on the south coast of Australia, continues over the South Indian and South Atlantic to the coast of South America. It also forms a belt outside the Tropics across the North Pacific and across the North Atlantic, also filling up the Mediterranean. Detached bands of water between 60° and 70° cross the great ocean basins approximately in the latitudes of the Tropics, separated by a great belt at a temperature between 70° and 80°. A temperature of over 80° occurs in the equatorial regions from long. 60° E. in the Indian Ocean to long. 170° W. in the Pacific, and probably off the coast of Yucatan the temperature does not fall below 80°. The surface of the ocean when the temperature falls below 40°, in the coldest months of the year, is about 25 per cent. of the water surface of the globe.

In the map of maximum temperatures the water under 30° does not appear, and the line between the blue and red colours, that is, the isotherm of 50°, approximates in the south to the parallel of 50°, and in the north to the Arctic Circle. The most striking feature is the great circumtropical belt with a temperature between 80° and 90°, while in the Red Sea and Persian Gulf the temperature in some places exceeds 90°. Water having a maximum temperature under 40° covers 13 per cent. of the water surface of the globe.

Surface water having a mean temperature under 40° F. covers an area of 21,800,000 sq. miles, or about 16 per cent. of the water surface; while 115,400,000 sq. miles, about 84 per cent., have a mean surface temperature above 40° F.

As regards the total volume of ocean water, it has been roughly calculated that more than 80 per cent. is at a temperature below 40° F., while 20 per cent. is warmer.

The results suggest several points of much interest to the biologist and zoologist. In water above 60° F. a more abundant secretion of lime takes place than in cooler water, and where these high temperatures prevail coral reefs are found. It appears that 4,000,000 sq. miles, or 3 per cent. of the floor of the ocean, present conditions favourable to the vigorous growth of coral reefs and of organisms which require a temperature of 60° F. all the year round. Again, more than half the surface of the ocean never has a temperature falling below 60°, and in these surface waters there is abundant secretion of carbonate of lime by pelagic molluscs, foraminifera, etc., and of silica by radiolaria and diatoms. The dead shells of these organisms fall to the bottom of the ocean, forming the oozes, as well as a considerable part of the red clay and blue mud deposits. Here they are mingled with the remains of organisms which have spent their whole life in water only two or three degrees above the freezing-point of fresh water. The bearing of this on the study of fossiliferous marine rocks is evident.

Soundings in the Antarctic.—Mr. H. Arctowski, of the Belgian Antarctic Expedition, has contributed to the *Geographical Journal* for July a few remarks on the bathymetry of the seas visited, accompanied by two charts. At Staaten Island the continental shelf is very narrow and terminates in an abrupt slope, the maximum depth, 2209 fathoms, having been sounded close to the island. To the east the continental shelf is continued for a considerable distance in the Burdwood bank. A large flat-bottomed depression lies between South America and the Antarctic continent, gently rising towards the south, and terminating in an abrupt slope leading up to the rocky shallows near Livingstone Island. The last sounding taken, in lat. 56° 28′ S. and long. 84° 46′ W., was 2625 fathoms, and showed that the depth increases towards the Pacific Ocean. Mr. Arctowski suggests that a submarine ridge, joining Patagonia and Graham's Land in a great curve, closes this basin on the east.

Soundings in the pack between Alexander Land and Peter Island demonstrate the presence of a continental shelf. A submerged bank, 200 to 300 fathoms below the surface, terminates abruptly towards the ocean. It is the 100-fathom line that is usually considered the limit of the continental shelf, and it appears possible that in the Antarctic regions the continental shelf has sunk. But more soundings are necessary to decide the contour of the ocean bed.

Consequent and Subsequent Streams.—Professor W. Morris Davis has sent us the following instructive note :—

"Will you allow me to make brief comment on two paragraphs in Mr. V. Dingelstedt's interesting article on the 'Hydrography of the Caucasus,' published in your June number? On p. 299 reference is made to the abrupt changes in the direction of certain Caucasian rivers, and although it is not proved that these changes are the result of the migration of former divides, it is said that 'such sharp turns in the course of a stream' may be called 'elbows of capture.' The turns may be certainly called 'elbows,' but until capture is proved to have taken place, they should not be called 'elbows of capture.' It is quite possible that the transverse part of such a bent river may be as old as the longitudinal, and that both may be consequent on original deformation. The transverse Rhone below Martigny, and several other transverse rivers of the western Alps, by which the longitudinal streams of inner valleys turn outward through deep gorges, are plausibly explained as consequent streams, located on sagging anticlines; and in such cases the elbows between the longitudinal and transverse parts of the streams are not 'elbows of capture,' but original elbows, consequent on the irregular folding of the Alps.

"On p. 300 it is implied that any stream running along the strike or perpendicular to the direction of dip, may be called a 'subsequent' stream; but as this term was originally used, it was limited to those streams that have grown by headward erosion along the strike of a group of weak strata. Hence distinction should be made between two classes of strike streams: one class including those that follow the axes of synclines, and which may therefore be called longitudinal consequents; the other class including those that follow the weaker members of anticlinal or monoclinal structures, and which may be called subsequents. A mountain range as young as the Caucasus probably retains still some examples of longitudinal consequents; it has even already developed some subsequents along the weaker anticlines. The young Jura mountains are notable for the number and importance of their longitudinal consequents, and for the small development of subsequents: the much older Alleghenies have few, if any, longitudinal consequents, but a great number of well-established and typical subsequents."

MISCELLANEOUS.

The **Society's Rooms** will, as usual, be closed during August for cleaning.

In the *Annals of Scottish Natural History* for July Mr. Barrett-Hamilton describes two new species of mouse from **St. Kilda.**

It has been thought that the **buffalo** was extinct in Canada, except the few specimens kept in captivity. Inspector Rutledge, however, of the North-West Mounted Police, reports that buffalo still exist near Fort Resolution, 900 miles north of Edmonton, and are increasing in numbers. The Dominion Government will do its best to protect them.—*Canadian Gazette*, June 29.

The population of **North-East Siberia** is estimated at 17,500. About 10,000 Chukchis live between the Kolyma River and Bering Strait. South of the Chukchis some 4000 Koriaks and Kamchadales dwell on the shores of the Sea of Okhotsk and on the Kamchatka peninsula, while the remainder consist of 3000 Russians, a few Lamuts, Yukaghirs, and Yakuts.—*Le Mouvement Géographique*, No. 24.

Two parties will be at work this summer in **Alaska**. They will cross from Skagway to near Lake Bennett by the new railway. The one party will then travel north-westwards along the base of the Mt. Elias range to the head-waters of the Copper River and the Tanana, while the second will proceed to the north of the Yukon, and making portages to the Koyukuk, will explore this and other streams flowing in from the north.—*Bulletin of the American Geogr. Soc.*, No. 2, 1899.

Professor Augustin Bernard read a paper before the French Geographical Congress in April on the question of a **Transsaharan railway**, so frequently advocated. Professor Bernard very sensibly holds that such a railway is useless at the present, and points out that railway construction would be far more profitable in Tonkin and Madagascar. A railway from the Sud-Oranais to Tuat would give communication to a rich group of oases, and have a strategic value from its proximity to Morocco.

By the grant from the Government of £45,000, the equipment in an efficient manner of an **Antarctic Expedition** is now secured. £15,000 are still required to fit out an expedition on the scale desired by the Committee, and these will certainly be forthcoming now that the despatch of an expedition is no longer doubtful. The Premier of Queensland proposes to ask for a grant of £1000 from his Government, and it is hoped that the other Australian colonies will follow the example. There will still, however, remain a sum to be made up by private donors.

Major Ronald Ross, of the Liverpool School of Tropical Medicine, has arrived at the conclusion that **malaria** is not conveyed to human beings by mosquitos of the genus *Culex*, but by members of the genus *Anopheles*. The former generally breed in pots and tubs of water, cisterns, and other artificial receptacles, whereas the latter breed in puddles and natural collections of water in general. At any rate, whether the dangerous mosquitos are confined to the genus *Anopheles* or not, they are certainly not of the domestic kind. An expedition is to set out for West Africa to make inquiries as to their habits and the best methods of repression. If the malaria in a town arises from a few puddles which can be obliterated at small expense, a great advance will be made in combating the disease.

The Railways of Siam are making rapid progress. The railway from Bangkok to Korat, which follows the Menam to Ayuthia and then turns eastwards, is 165 miles long. The sections Bankok-Ayuthia (44 miles) and Ayuthia-Genkoi (34 miles) have been open eighteen months, and the whole line will be completed, it is hoped, by April 1900.

Other projects are for a line from Ayuthia to Lophburi, and from Bangkok to Pechaburi. The former, 28 miles long, is only the beginning of a great trunk line to Chiengmai (370 miles), which is ultimately to be prolonged into China. The Lophburi line also is to be ready by April 1900. The Pechaburi railway (100 miles) is intended to connect the Malay peninsula more closely with the continental part of Siam. It is to be continued eventually to a point on the east coast in about

the latitude of Penang.—*Mitth. der k.k. Geogr. Gesell. in Wien*, Bd. xlii. Nos. 3 and 4.

The Livingstone Memorial.—Sir Henry M. Stanley has proposed that a suitable monument should be erected on the spot where the heart of Dr. Livingstone is buried. The heart and more perishable parts were placed in a tin box, and were buried at the foot of a tall tree at the old village of Chitambo. Above the grave was carved on the tree in bold letters:—"Dr. Livingstone, May 4th, 1873. Chuma, Suza, Muiasere, Chopere." These names are those of Dr. Livingstone's four headmen. When this tree falls—and it is fast becoming a mere shell—there will be nothing to mark the site of the great explorer's last halting-place.

A movement was started among the residents in Nyassaland to raise a monument, but, though they liberally responded to the appeal for funds, they could not accomplish their object. Sir H. M. Stanley has discussed the question with the Nyassa committee, and a bronze obelisk has been fixed on as suitable for the situation, and able to resist the weather, fire, etc. The dimensions are 48 feet long, and 7 feet square at the base. The cost will be £2085, and of its transport to Old Chitambo's, £1156, making with other incidental expenses £4000. The British South African Company has undertaken to transport the column and material for its erection through their territory, and the African Lake Corporation offer to transport it by their steamers from Chinde to the Upper Shire free to the extent of £250. There remain, then, about £3500 to be provided.

Messrs. Barclay and Co., Bankers, 1 Pall Mall East, will be happy to receive subscriptions.

NEW BOOKS.

The Break-up of China. With an Account of its Present Commerce, Currency, Waterways, Armies, Railways, Politics, and Future Prospects. By Lord Charles Beresford. London and New York: Harper and Brothers, 1899. Pp. 509. *Price* 12*s.*

Lord Charles Beresford went out to China on behalf of the Associated Chambers of Commerce to inquire into the conditions of foreign commerce in that country, the hindrances to the further expansion of trade, and the remedies. The volume, besides the author's own observations, contains commercial statistics and the opinions of mercantile bodies and individuals.

Though the object of the mission was, in the first place, commercial information, the internal politics of China occupy a large part of the volume, the chief obstacles foreign merchants have to contend with being those due to want of security for life and property and the evasion by the Chinese officials of the treaties regulating the introduction of goods into the country. Money would be provided for railways, the regulation of rivers, the working of mines, etc., were facilities afforded. But the corruption of officials puts an insurmountable barrier in the way. The provincial troops are not kept to their full strength and properly equipped, because the greater part of the money devoted to that purpose is embezzled by the generals; mines cannot be worked, even where a concession has been obtained from the Yamen, because the provincial authorities refuse their consent; and likin duties are levied on goods where by treaty they should go free. The Chinese merchants of Hongkong put the case of China in very strong terms.

"She is," they wrote, "nearly rent asunder by internal dissensions and rival factions. Her officials are the most corrupt and notoriously incompetent; her revenue is ridiculously insufficient, and already overcharged with payment of interest on foreign loans; her land is infested with rebellious bands and lawless mobs; her people are ignorant and full of prejudice and pride." This state of things is, to a great extent, due to the totally inadequate salaries paid to officials, which they are absolutely obliged to supplement by illegitimate means, or they would not be able to pay their staffs and keep up the necessary state.

The first step to the introduction of a more satisfactory state of affairs is, in Lord Charles Beresford's opinion, to reorganise the army under European officers, and many of the officials with whom he conversed appeared to be very favourably disposed to this plan, while a few were indifferent or expressed their preference for the present system. Whether the former were at heart convinced that the integrity of China can only be maintained by some such measure, or whether they have the courage and energy to advocate reform, may be doubted. There are certainly some honest men among the Chinese officials, of whom General Yuan Shi Kai is a brilliant example: he spends the money he receives for his army as intended, and consequently commands "the only army complete in all detail, according to European ideas, that I found in China." But that the mass of officials, military and civil, is thoroughly corrupt is shown by the state of the other armies and the fact that the net revenue is only one-fifth of the amount actually collected. Few of them probably would willingly exchange their opportunities of gain under the present system for fixed salaries, though on a liberal scale. There is also a small reform party which desires the welfare of its country, but it has been too hasty and unmethodical.

Yet Lord Charles Beresford apparently thinks it is not too late to set China on her legs again, though he entitles his book "The Break-up of China." And no doubt internal security is the first step. It would facilitate commerce and obviate the necessity of interference of foreign Powers for the protection of their subjects. But if measures of reform be not speedily taken, the policy of the "open door" must give place to that of "spheres of influence," leading up to the dismemberment of the empire.

The "open door" is not the policy of all European Powers, and unless a determined attitude is assumed by the British Government, British merchants will be excluded from the most lucrative markets. Russian trade with Manchuria is almost nil, while British trade is rapidly extending, but the Russians are acting in the most arbitrary manner in that country, filling it with troops, taking land for their railway at any price they choose to pay, and granting no compensation for the crops they destroy, evidently looking upon the country as already their own. The exclusion of merchants of other nations is merely a question of time. In the south the French are encroaching in Sze-chuan, in the so-called British sphere of influence, and in the provinces of Kwang-si and Kwang-tung, where most of the trade is in British hands.

Many complaints are made of the consular service in China. British consuls do not render the assistance in commercial matters that is afforded by those of other countries, partly because their time is too much taken up by judicial and other matters, and partly because they are not, as a rule, business men. It is very singular that Chinese subjects of Great Britain should not be protected in China itself by the representatives of the Government to which they owe allegiance.

The volume also contains much useful information on railways, waterways, currency, and other subjects intimately connected with trade, as well as chapters on Japan and the United States, with an account of the feeling in those countries

in regard to the Chinese question. It is a book which every student of the present crisis ought to read.

Vom Mittelmeer zum Persischen Golf, durch den Haurān, die Syrische Wüste, und Mesopotamien. Von Dr. Max Freiherrn von Oppenheim. Erster Band. Berlin: Dietrich Reimer, 1899. Pp. 334.

In this, the first volume of an important geographical work, the author narrates his journey from Beirut on the Syrian coast through Damascus, the Haurān, Harra, and Safā, Dumēr and Palmyra, and the Syrian desert to the Euphrates. Freiherr von Oppenheim was singularly well equipped for such a journey as this. A leading official of the German General Consulate at Cairo, he possessed all the official authority necessary for travellers through Turkish territory, besides knowing how to overcome the difficulties they are sure to encounter. Thoroughly conversant with the Arabic language, and long familiar with Arabic and Turkish manners and customs, he was able to traverse a country which a tyro would have found impassable. Above all, a master of ancient inscriptions, and practised in scientific research, he brought the ripe learning of the West to decipher the secrets which had so long lain hidden in this portion of what the Germans romantically style "the Land of the Morning."

The work is founded upon the details of a journal kept by the author during his journey in the summer of 1893. The task which he set himself was not merely to describe his route, but to depict the people and country from an historical, ethnographic, and religious point of view. Whilst detailing this, he directs attention to the extensive literature dealing with the history and geography of Syria and Mesopotamia, and which, whilst including ancient Greek, Roman, and Arabic authors, also comprises modern Arab chroniclers, and a long series of old European books of travel and numerous modern works of scientific research.

After reminding us that Beirut, the leading port of Syria, is an ancient Phœnician commercial town, the author states that the Christians of Syria still exhibit the old wandering spirit of the Phœnicians. They are to be found in North and South America, in Australia and Japan, as many as 10,000 annually emigrating to America, whilst in Australia their competition with the tradesmen of the smaller towns has now to be reckoned with. Since the massacres of 1860, and especially since the British occupation of Egypt, Syrian Christians have found their way to Egypt in ever increasing numbers, the leading British officials welcoming them, although the natives do not. At the same time, whilst Armenians and Copts have risen to Ministerial rank in Egypt, the Syrians have as yet only held inferior official posts, although editing most of the Egyptian newspapers appearing in Arabic. Exceptionally quiet and clever, the Syrian Christians are vain and crafty, whilst their women are often exceedingly beautiful. Owing to the influence of the French Roman Catholic missions, French has now taken in Syria the place which Italian once held. The British and American Protestant missions and schools have not by any means achieved for the English language the same position as the French. In 1895 the following steamers entered the port of Beirut: 149 British, 120 Austro-Hungarian, 98 Egyptian, 97 French, 86 Turkish, 49 Russian, and 16 Italian.

At Damascus ("a tourist city *par excellence*"), which is fully described, the author organised his expedition to Bardād, and got together a caravan consisting of ten persons. He visited and devotes a chapter to the Druses, a wonderful race, the religion and history of which are still a mystery. Whilst the French Government supported in Syria the Maronites, the British protected the Druses, and the

author saw in the latter's cottages the portraits of Lord Dufferin and other famous Englishmen occupying a place of honour.

Wherever the author goes he records and translates the Arabic inscriptions he observed, and with the aid of beautiful illustrations he shows us the buildings of note, remarkable decorations, and types of the people. He considers that Syria and the Haurān formed the cradle of Arabian art. Arriving at the site of Palmyra, once the centre of commerce across the Syrian desert, he contributes pages of plates illustrative of the splendid architectural remains there. Palmyra (the modern *Tadmur*) is not, he says, to be confounded with "*Tadmor* in the wilderness" which Solomon built (1 Kings ix.), as some have conjectured.

Altogether this volume is remarkable for its comprehensiveness and scholarship, as well as for the many features of general interest which it contains. It is excellently printed, lavishly illustrated, and is accompanied by maps by Dr. Richard Kiepert, showing the line followed by the author during his often adventurous journey, which included several new routes, in the course of one of which the author ascended the volcano of Safa.

L'État Indépendant du Congo. Historique—Géographie physique—Ethnographie—Situation économique — Organisation politique. Par A. J. Wauters. Bruxelles : Falk Fils, 1899. Pp. xiii + 527.

This is a work which M. Wauters has long had in view. Its aim is to give a concise account of the Congo State, and it is designed to meet the demands of schools and colleges in Belgium, where the geography of the Congo has been recently included in the programme of secondary education. In a work of this kind, knowledge and judgment, accuracy and common sense, are above all requisite. It need hardly be said that no man is better fitted for the task than the director of the *Mouvement Géographique*, in the columns of which a good deal of it, we think, has appeared from time to time. It seems to us that M. Wauters has produced an admirable work, which is well fitted not only to meet the immediate demands of education, but also to meet the wants of the generality of readers.

It is divided, as the title-page indicates, into five parts. In the first there is an interesting review of the history of discovery, exploration, and occupation of the Congo Basin, and the foundation and progress of the Congo State, with a short account of more recent exploration and expeditions, such as that of Katanga and the expeditions to the Upper Nile. One chapter deals with the slave-trade and the struggle between the Belgians and the Arabs on the Upper Congo. Another deals with the history of missions, catholic and protestant, and a final chapter discusses the relations of the Congo State and Belgium. In the second part there is an excellent account of the orography and hydrography, in which a mass of information has been reduced to a concise and lucid order. Other two chapters deal with the flora and fauna. In this part M. Wauters has had the collaboration of M. J. Cornet on the geology, M. A. Lancaster on the climate, and Dr. Jullien on the sanitary conditions. The third part deals in five chapters with the ethnography, and describes not merely the several races and tribes, but also the social state, manners and customs, agriculture, industry, and native trade. The fourth part consists of seven chapters, and surveys the economic characteristics—such as products, handicrafts, ways of communication and means of transport, the internal trade, both private and State, articles of importation, and statistics of foreign trade. The last part deals in five chapters with the political organisation

of the State, its constitution, its territory, its legislative, administrative, and judicial powers, and, finally, its government.

Throughout his work M. Wauters has made it his aim to avoid as much as possible all debatable questions. He has himself borne no slight part in the opening up of the Congo; but he has refrained from insisting on his own personal views. His work is an admirable account of what the Congo State has achieved.

The Congo State is now organised into 14 districts, in accordance with decrees of the 1st of August 1888, and 17th of July 1895. On the 1st of January 1898 there were 265 localities occupied by white men, who numbered 1,678. The following is a list of these districts, with the capital of each, the number of places inhabited by whites, and the estimate of the white population:—Banana district, capital Banana, 25 posts occupied by whites, 93 white population; Boma, Boma, 12, 248; Matadi, Matadi, 19, 372; Cataractes, Tumba, 20, 81; Stanley Pool, Léopoldville, 30, 214; Kwango oriental, Popokabaka, 13, 34; Ubangi, Banziville, 6, 16; Stanley Falls, Stanley Falls, 32, 160; Lualaba-Kasai, Lusambo, 23, 90; Lac Léopold II., Kutu, 7, 15; Équateur, Coquilhatville, 29, 99; Aruwimi, Basoko, 12, 34; Bangala, Nouvelle-Anvers, 16, 85; Uele (Welle), Djabir, 21, 137. The Stanley Falls district is divided into six zones, namely, Stanley Falls, Tanganika, Kalambare, Manyema, Ponthierville, Haut Ituri. The Uele district is divided into four zones, namely, Rubi-Uele, Uere-Bomu, Makua, Makraka.

M. Wauters has introduced into his book what is now to be regarded as the official system of orthography; hence, Ndoruma, Ndirfi, Mbomu, Mbima, Mbili, appear as Doruma, Dirfi, Bomu, Bima, and Bili. Nyangara seems to remain, however, unchanged. Double consonants are to be avoided; hence, Welle and Werre become Wele and Were (Uele and Uere). Nsakkara or Sakkara is a case where both changes are introduced; but, according to the particular mention of the Duc d'Uzès, the double *k* is necessary to indicate the native pronunciation.

There are a good many tables and diagrams which afford a synoptic view of a mass of details; of these we may single out and commend those dealing with climate and hydrography. There is a map of the Congo State on a scale of 1 : 5,000,000, in which, however, there are several omissions which diminish its utility as an aid to the text. There is also an inset map of the Lower Congo and of the railway from Matadi to Stanley Pool on a scale of 1 : 2,400,000. A good index makes it a handy book for reference. Some misprints and other slips remain to be corrected. We commend it cordially to all who desire a general work on the Congo State.

Psychologie de la Colonisation Française dans ses rapports avec les sociétés indigènes. Par Léopold de Saussure. Paris: Félix Alcan, 1899. Pp. 311. *Price Frs.* 3.50.

In this volume Monsieur Léopold de Saussure has taken upon himself the ungrateful but easy task of impugning and attacking the whole system of administration which now obtains in French dependencies. To him, however, it is a formidable task, for he has against him the dead weight of the doctrinaires and theorists, who still adhere to the Contrat Social and the principles of last century, and the whole official staff now engaged in administering the dependencies, for whom to admit Monsieur de Saussure's contentions would be to admit that the whole colonial system is not only a failure but deserves to be so. The French system of administration of colonies is summed up in one word, viz., assimilation; and the process of assimilation is conducted especially on three lines, viz., religion, language, and judicial and administrative institutions. The assimilation in religion is

carried on by missionaries, that in language by schools, and that in judicial and administrative institutions by the subversion of all local institutions and by the substitution in their room of the latest productions of Parisian skill and enlightenment. Monsieur de Saussure has no difficulty in showing that in Tonkin, Annam, etc., the process of assimilation has been a conspicuous failure in each and all of these lines. But his difficulties are not over. For instead of frankly confessing its errors and retracing its steps, the French Colonial Office adheres to its unimpeachable principles, and attributes all its colonial failures to the officers who are intrusted with the work of administration. When anything breaks down time after time, it is not the system that is changed, but the local officer who has been directed to achieve the impossible. And we suspect that Monsieur de Saussure has incurred no small opprobrium by the undisguised and unconcealed admiration with which he views the British system of administration, especially in India. It required no small courage for him to say: "Le caractère est formé par la combinaison, en proportion variée, des divers éléments que les psychologues désignent habituellement aujourd'hui sous le nom de sentiments. Parmi ceux qui jouent le rôle le plus important, il faut noter surtout, la persévérance, l'énergie, l'aptitude à se dominer, facultés plus ou moins dérivées de la volonté. Nous mentionnerons aussi, parmi les éléments fondamentaux du caractère, et bien qu'elle soit la synthèse de sentiments assez complexes, la moralité. . . . Le caractère d'un peuple et non son intelligence détermine son évolution dans l'histoire et règle sa destinée. On le retrouve toujours derrière les fantaisies apparentes de ce hasard très impuissant, de cette providence très fictive, de ce destin très réel, qui, suivant les diverses croyances, guide les actions des hommes. L'influence du caractère est souveraine dans le vie des peuples, alors que celle de l'intelligence est véritablement bien faible . . . C'est par le caractère que 60,000 Anglais tiennent sous le joug 250 millions d'Hindous, dont beaucoup sont au moins leurs égaux par l'intelligence, et dont quelques-uns les dépassent immensément par les goûts artistiques et la profondeur des vues philosophiques. C'est par le caractère qu'ils sont à la tête du plus gigantesque empire colonial qu'ait connu l'histoire."

It is abundantly clear that Monsieur de Saussure has made a profound study of the history of the spread of English rule in India, and he has no difficulty in putting his finger on the difference between the English and French systems. In the former we accept facts and the *status quo*, and rule our subjects as much as possible through themselves and their own institutions and language, interfering as little as may be with their religion. The French system is to turn every possession by a stroke of the pen into a prefecture to be administered under the Code Napoleon and the general laws of France. The fallacies which underlie the French system are very obvious to us Anglo-Saxons. The one is that the system of government in France, including its language and its religion, is the best in the world. The other is that, if we concede that the French system of government is the best, it follows that such a system can be advantageously applied at once to such uncivilised countries as Annam, Tonkin, etc. The mere statement of these propositions secures for them their rejection on this side of the Channel. *Festina lente* is to us a sound maxim of administration in semi-civilised states, but one which our French neighbours unhesitatingly reject; and probably it will not be till the expense of repeated failures in their dependencies becomes unbearable to the mother-country that she will retrace her steps. In the meantime we shall look with interest, and it may be amusement, at the enterprise of assimilating the new dependency of France, *i.e.* nearly the whole centre of the continent of Africa west of the Nile Basin. One or two simple problems in arithmetic will need

solution ; *e.g.* if it takes 50,000 troops (as Monsieur de Saussure informs us) to hold French Algeria with its three and a half millions of inhabitants, how many men will be needed to hold the rest of the African possessions? and again, what will be the cost of assimilating and administering on French lines a dependency some twenty times the size of France? When brought face to face with these and similar problems, the French Colonial Office will probably be found willing to admit the force of Monsieur de Saussure's arguments and to reconstruct from top to bottom its colonial system.

Funafuti; or, Three Months on a Remote Coral Island. By Mrs. Edgeworth David. London: John Murray, 1899. Pp. 318. *Price* 12*s.*

The different theories regarding the origin of coral reefs and atolls propounded by Darwin, Murray, and others, led to a succession of three expeditions to the island of Funafuti, in the Ellice group, for the purpose of testing these theories by deep borings. The second of the expeditions was under the leadership of Professor David, of Sydney University, and it is by his wife, who accompanied him, that this volume is written. Disclaiming all scientific knowledge, she has yet provided a book of interest both to the scientist and to the general reader. For in Funafuti she found an interesting social condition arising from the recent ascendency of missionary influences, while still the old ways remained. She notes many instances which came under her observation during her three months' stay, and by her success in gaining the confidence of the islanders she has been enabled also to preserve a record of obsolete customs, folklore, etc. The flora and fauna receive attention, and the whole book is written in a light and clever style which takes the reader easily along. Mrs. David has made good use of her opportunity.

Volcanoes, their Structure and Significance. By T. G. Bonney, D.Sc., LL.D., F.R.S. London: John Murray. New York: G. P. Putnam's Sons, 1899. Pp. viii + 337. *Price* 6*s.*

This book contains an account of the chief observed facts concerning volcanoes —active, extinct, and fossil—and of the theories which have in recent times been put forward in explanation of volcanic activity. It is intended for "the ordinary reader." Whether in view of the existence of the similar treatise by Professor Judd the publication of this volume was called for, the reading public will decide for the publishers in a practical fashion. Meanwhile it may be said that the book is convenient in size and well arranged, is sufficiently supplied with references to authorities, and is well printed and illustrated. We have noticed some defects of composition. Such, for example, is the use throughout the book of the words "this" and "that" (with or without the addition of "one"), and "former" and "latter," as substitutes for the subject or object of the clause. The substitution in most cases makes for neither perspicuity nor elegance of expression. As instances (among many that might be specified) of clumsy and inexplicit sentences may be noted the sentence at the foot of p. 226, beginning "Junghuhn states . . .," and that at the top of p. 275, beginning "We have not attempted . . ." Scientists are wont to study accuracy in observation and neatness in manipulation. Is it too much to expect from them the same qualities in their written expositions? Although however the author, judged from this book, is not master of an exact and simple literary style, he is otherwise a thoroughly equipped exponent of the subject of the volume. In further praise, the book may be said to be throughout uncontroversial, undogmatic, and impersonal in tone.

Of the six chapters comprised in it, five are devoted to the description and topography of volcanic and plutonic phenomena. Under the title of "The Life-History of Volcanoes," the first chapter brings together the more important observations recorded regarding recent volcanic outbreaks. Vesuvius and the adjacent Italian and Mediterranean volcanoes, Bandaisan in Japan, Krakatoa, the volcanoes of the Sandwich Islands, Skaptár Jökull in Iceland, Cotopaxi, Bogosloff in the Behring Sea, the mud-volcanoes of Kertch and of Krafla in Iceland, the geysers of the Yellowstone Park and of Iceland, are passed in review before the reader. The second chapter describes, without excess of detail, the products of volcanoes—the chemical composition and the structure of the fragmental and massive materials issuing from volcanic ducts and fissures. The third and fourth chapters treat of extinct, wrecked or ruined, and fossil volcanoes, the object being to demonstrate such phenomena as are not visible in active volcanoes which cannot be (in the author's phrase) dissected. A description is therefore given of the volcanic features belonging to past geologic ages which are now exposed by denudation in various districts of the globe, notably in Auvergne, the Eifel, Schemnitz in Hungary, and the British Isles. The reader of these four chapters cannot fail to grasp what a volcano is, and what the manifestations of volcanic energy have been: that, by means of violent gaseous explosion or gentler extrusion through holes or rents in the outer crust of the globe, volcanoes are built up of mineral dust, scoria, and lava; that, in connection with the original channels of issue, they are generally traversed by pipes terminating in a bowl-like cup or crater and by fissures, through which eruption and extrusion of volcanic matter are continued or from time to time renewed; that extensive regions which have been the seat of volcanic activity may not only have possessed volcanoes, but often have been traversed by far-reaching rents and seams of the globe's crust which have been filled in with volcanic matter.

The fifth chapter contains an account of the geographical and physiographical distribution of active, and recognisable extinct, volcanoes. A map accompanies it. The subject is obviously related to investigations into the causes of volcanic activity, and is fully dealt with by the author.

In the last chapter theories respecting the causes and processes of vulcanicity are discussed, and the more important of these theories have been well summarised and worked into the chapter. The conclusions arrived at on a few of the problems involved may be accepted as fairly well established. There is little room for reasonable doubt that the material which in the shape of lava, scoria, and volcanic ash is ejected or squeezed through orifices and fissures in the crust of the globe, is derived almost wholly from an intensely heated mass which is reached at a depth of some miles below the upper surface of the crust. It is also fairly certain that the source of the explosive power exhibited in volcanoes—the irritant of eruption, as the author calls it—is to be found in the presence of water, either enclosed in or coming into contact with the heated material in its subterranean storehouse and in the vent of issue; and that the presence of water, together with varying pressure, materially affects the specific gravity and fluidity of the subterranean mass. But science has still to prove what the forces are, and what their way of working, whereby the plutonic masses now exposed by denudation here and there on the earth's crust, as well as the volcanic material intruded into and ejected through the crust by the explosive energy of steam and other gases, were brought up from the depths of the interior. It has also to show why these forces have manifested themselves in certain regions in various ages for longer or shorter periods, once for all or intermittently after longer or shorter intervals of repose. And, further, there is the question how it comes that although the extruded

matter has all along possessed a common mineral constitution, it varies chemically, within certain proportions of the acid and basic elements, in what frequently seems to be a definite sequence, in different regions and ages, or in the same regions in different ages, or at intervals of time possibly not very far apart, or at one and the same time.

The last of these problems, as the author states, has engaged the attention of geologists in recent years. He gives at some length the various hypotheses bearing upon the subject. But the outcome of the argument as summarised in a sentence at the top of page 331 is little better than a conjecture.

The theories which have been advanced as to the causes of the other phenonema above spoken of are also discussed by the author. Pressure, mainly due to the secular cooling of the globe, is assumed to be the principal force which raises from the depths of the earth the igneous matter and moves it into position for ejection or intrusion. Pressure from contraction probably induces also the foldings and fractures of the crust wherein the heated matter, in fluid or viscous form, finds the fissures, orifices, and cavities by which it makes its way into and through the crust. But how and why it produces the local results which we see, and how far it is aided or modified by other causes than the secular cooling, such as deposition and denudation upon the surface of the globe, and by unknown conditions in the interior, is unexplained.

The imperfection and uncertainty of our knowledge of the causes of vulcanicity, as distinguished from its phenomena (all the more important of which have probably been already observed and recorded), are fully acknowledged at the close of the chapter. It concludes with an expression of the author's expectation that during the next quarter of a century great progress in the investigation into these causes is likely to take place. Every one for whom physical science has any attraction will share the wish that this expectation may be fulfilled.

The book will, we hope, have many readers—and purchasers.

The History of Corsica. By L. H. Caird. London : T. Fisher Unwin, 1899. Pp. 179. *Price* 5*s.*

This is a very careful, although somewhat prosaic, account of the romantic history of a most interesting island. Corsica requires some book like Scott's *Tales of a Grandfather* to awaken British feeling, and to remind us that its mountaineers waged, like the Scots, a War of Independence, and had national heroes like Sampiero, and traitors like Vittolo, just as the Scots had their Wallace and Menteith.

Mr. Caird says that "the first inhabitants (of Corsica) are supposed to have come from Spain and Liguria," but the Corsican Abbé, F. Girolami Cortona, in his *Géographie générale de la Corse* (Ajaccio, 1893), holds that the aborigines of the island were an Aryan race of Asiatic origin, and were followed long afterwards by Ligurians and Celts.

As the book is presumably for British readers, it is disappointing that the period from 1794 to 1796, when Corsica was a British possession, is dismissed in a few lines. The author does not seem to have consulted regarding this period the interesting publication in 1892 of the Bastia "Société des Sciences Historiques et Naturelles de la Corse," explaining from contemporary documents the difficulties which Sir Gilbert Elliot (afterwards Lord Minto) experienced as British Viceroy of the island, which was abandoned not altogether (as the author says) because "British rule did not please the Corsicans."

The Corsicans passed from British into French hands, and the author maintains

that they are "still denied self-government"; but they have virtually Home Rule, for, beyond sending them a French préfet, and expending far more money upon the island than it yields, the French Government leaves the Corsicans very much to themselves. They are too independent a people to be much meddled with.

Commercial Geography of the World. London: Sir Isaac Pitman and Sons, Ltd., N.D. Pp. 264. *Price* 2*s.* 6*d.*

No date and no author's name.

This is intended as a cheap text-book, and is a very fair specimen of its class. It professes to use "the most recent returns" connected with its subject, but yet does not bear the date of its publication. It is illustrated by numerous maps of varying quality, none very good. The commercial maps indicate clearly, but with varying accuracy, the localities whence things are obtained; that of the British Isles, p. 48, is very violently coloured; and that of the Canadian Pacific Railway is repeated without apparent reason. Greater care should be taken to make the maps agree with the text and with each other. We note on p. 9 the surprising statement that in 1852 M'Clure's ship made the North-west Passage; and among mis-spellings:—Rannock, Beauxite, sempernarens, and cansescens. Most of these points suggest that the book has been hastily prepared, and it certainly needs revision.

The Ideal Geographical Reader. Parts 4 and 7. London: Sir Isaac Pitman and Sons, Ltd., N.D. Pp. 208 and 248. *Prices* 1*s.* 4*d.* and 1*s.* 8*d.*

No date, and no author's name.

The ideal geography has yet to be written, but we think these books merit the title at least as well as others of the best of their class. Book 4 deals with the elementary notions of geography in a fairly satisfactory way, being at all events free from erroneous statements, and containing numerous illustrations. Book 7 deals with the special geography of the British empire, but we are at once offended by hopeless confusion between England, Great Britain, and Britain, and their respective adjectives. The information supplied is generally adequate and accurate; and the books will doubtless prove useful in the sections of a primary school, for which they are intended.

The Eastern Counties. With a Practical Section on the Rivers and Broads. By C. S. Ward, M.A. London: Dulau and Co., 1899. Pp. 144. *Price* 3*s.* 6*d.*

The "Thorough Guides" do not belie their name, and that on the Eastern Counties keeps up their character. It is equipped with a large number of good maps, and the chapter on Rivers and Broads is very useful to boating and fishing men.

Switzerland and the Adjacent Portions of Italy, Savoy, and Tyrol. Handbook for Travellers. By Karl Baedeker. Leipsic: Karl Baedeker, 1899. Pp. xxxiv + 512. *Price* 8*s.*

The eighteenth edition contains a few pages more than the last, which was issued two years ago. Some new maps also are added—of the Jura, Val d'Illiez, etc.

NEW MAPS.

EUROPE.

SOUTH NORTHUMBERLAND. Reduced Ordnance Survey Sheet 2. *Price* 2*s.*
John Bartholomew and Co., Edinburgh.

ASIA.

PHILIPPINEN, Karte der ——. Massstab 1 : 2,500,000. Mit einem Plan der Stadt Manila im Massstab 1 : 90,000. *Price M.* 2.
A. Hartleben's Verlag, Wien, Pest, Leipzig.

A clear and well-executed map of the whole archipelago from the Batanes island on the north to the Sulu group on the south. There is as a rule as much detail as can conveniently be given on the scale, except of course where, as in Mindoro and Mindanao, the interior is little known. But why is the railway from Manila to Dagupan omitted? Even Dagupan itself, the port of the neighbouring country, is not marked. The plan of Manila is rather too small to be of much use.

MANILA, Map of the country round ——. Compiled and reproduced in the Intelligence Branch from Spanish Maps, dated 1893 and 1897.
Presented by the Quarter-Master-General, Intelligence Branch, Simla.

In the above map, Luzon from a little north of Lingayen Gulf to the 13th parallel is represented on a large scale—about 11 miles to the inch. The railway and roads are shown, and as many names are inserted as can be conveniently included in the space.

The map may be obtained from the Superintendent of Government Printing, Calcutta, for the price of one rupee.

AMERICA.

AMÉRIQUE DU NORD. Physique. Atlas Universel de Géographie.
Hachette and Co., London.

In style this sheet corresponds to the map of South America already noticed. For the United States Mr. H. Gannett's well-known map has been utilised and the late explorations in Labrador and Alaska have furnished new material.

ATACAMA, Carta Geografica del Desierto i Cordilleras de ——, levantada por la Comision Exploradora de Atacama, Francisco J. San Roman, Ingeniero Jefe. 5 sheets. Escala 1 : 750,000. 1890.
Direccion General de Obras Públicas, Santiago de Chile.

This map of Atacama is some years old, but very probably is not very widely known. The copy presented to the Society has the new railways, projected or under construction, marked on it.

CHARTS.

SCOTLAND. West Coast. Loch na Keal. No. 3015.

——. East Coast. Firth of Forth—Fisherrow to Port Edgar. No. 114B.
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VANCOUVER ISLAND, B.C.

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THE first view of Vancouver Island, whilst coasting northwards along the western coast of North America, is obtained between the parallels 48° and 49° N. lat., and about 125° W. long. The voyager may behold, rising in the distance, a bold and rugged outline of what appears to be the inhospitable shore of a wild country.

Eastward, stretching on the left hand far into the north-west horizon, is a mountainous range, rising abruptly from the ocean: rugged and broken, presenting an outline of varied mountain scenery—"the sharp solitary peak, the broken sierra, and the rounded dome-shaped mass, reflecting in the western sunlight, from their various surfaces and angles, the rays of light in infinite variety of hue, from the dark indigo of the lower ranges to the rosy purple of the peaks."

Entering the Strait of Juan de Fuca, which is not more than ten or twelve miles in width, and passing the Cape Flattery lighthouse, the voyager sees on the right hand the snow-capped range of Olympia, its dark and frowning precipices descending gloomily to the shore. On the left hand, reflecting a purple light, the metamorphic and trappean rocks of Vancouver, with a fringing belt of yellow sandstone; and sweeping on for about sixty miles, he sees before him Race Rocks lighthouse, beyond which a magnificent panorama opens to his view—a picture which, viewed by the warm sunlight of a fine autumnal day, can nowhere be surpassed for beauty of outline or richness and variety of colouring.

The rounded trappean hills of Vancouver Island are in full view on his immediate left, covered nearly to the summits by thick vegetation, the purple tints of the bold, outstanding rocks mingling in harmony of tone with the dark green of the pine and the oak; while below, in the valleys and lower grounds, the cool greys of the rounded rock masses,

fringed by a thick carpet of purple-brown fern, join with the autumnal orange tints of the maple, and the bright, yet tender, green of the alder and the willow, to form a mass of colour on which the eye dwells with delight.

From port San Juan, through the Strait of Fuca, eastwards, the coast is bold and rocky; numerous creeks and inlets, however, give protection to small craft, and Sooke Inlet is well adapted for coasting vessels and small steamers.

Before reaching Esquimalt harbour, distant eight and a half miles from Race Rocks lighthouse, an undulating, parklike country, backed by wooded hills of moderate height, appears in view, forming a succession of low, rounded, rocky promontories, with outlying reefs and islands. Esquimalt harbour, the headquarters of the British fleet on the Pacific coast, is a safe and excellent anchorage for ships of any size, and with the aid of the light, which marks the western point of entrance, may be entered at any time with great facility. The extent of the harbour is about three miles by two, with an average depth of from six to eight fathoms. It has a commodious and large dry dock, and is well fortified. A branch of the Esquimalt and Nanaimo railway connects at one side, and around the whole harbour numerous rocky promontories, with outlying islands and gently sloping sandy bays, form the chief feature of the scene.

Victoria harbour is a little more than two miles eastward of Esquimalt. The entrance is described as "shoal, narrow, and intricate, and with SW. or SE. gales a heavy rolling swell sets in on the coast, which renders the anchorage outside unsafe; while vessels of burthen cannot run in for shelter unless at or near high water. Vessels drawing fourteen or fifteen feet of water may under ordinary circumstances enter at such times of tide, and ships drawing seventeen feet have entered, though only at the top of spring tides."

The foregoing quotation was written some years ago. Since then many improvements have been made. An outer harbour has been constructed, where Australian and the Chinese line of C. P. railway steamers can call, and the town of Esquimalt is connected with Victoria by an electric tramway.

The celebrated Captain George Vancouver, whose name the island now bears, describing a portion of this locality in 1792, says:—"To describe the beauties of this region will, on some future occasion, be a grateful task to the pen of the skilful panegyrist. The serenity of the climate, the innumerable pleasing landscapes, and the abundant fertility that unassisted nature puts forth require only to be enriched by the industry of man, with villages, mansions, cottages, and other buildings, to render it the most lovely country that can be imagined, whilst the labour of the inhabitants would be amply rewarded by bounties which nature seems ready to bestow on cultivation."

Such were the conclusions which Captain Vancouver came to one hundred and seven years ago. They appear to be correct. Although portions of Vancouver Island convenient to the coast are taken up and settled, much of the country is still unoccupied and even unexplored, still

open as it was in the days of Vancouver, calling for the labour of man to regulate its wild luxuriance and develop its latent wealth.

Vancouver Island is of an elongated, oblong form, running NW. and SE., in length about three hundred miles, with an average breadth of thirty to fifty miles. Its outline is boldly picturesque; its shores are characterised by abrupt cliffs, rocky promontories, magnificent harbours, sheltered coves, and pebbly beaches. Its surface is beautifully diversified by mountain precipices, hill and dale, and undulating prairies, the tameness of which is broken by numerous bosses of trappean rock, which rise on every hand, and round which the gnarled oak spreads its leafy arms, affording a grateful shade in the summer sun.

The general feature of the landscape in such localities is said to be very similar to many parts of Devonshire, more especially to that on the eastern escarpment of Dartmoor, and the resemblance is rendered more striking by the numerous stone circles which lie scattered around. The trappean rocks, which in Vancouver Island take the place of the granite of Devon as giving feature to the scene, furrowed, grooved, and scratched by ice action, point to a period far back in time when a submerged land lay under a Boreal ocean, and these stone circles point to a period in ethnological history which has no longer a place in the memory of man.

These stone circles are found scattered in irregular groups of from three or four to fifty or more, crowning the rounded promontories over all the south-eastern end of the island and as far north as Comox. Their dimensions vary in diameter from three to eighteen feet; of some only a single ring of stones marking the outline now remains.

In other instances, the circle is not only complete in outline, but it is filled in, built up as it were to a height of three to four feet, with masses of rock and loose stones collected from amongst the numerous erratic boulders which cover the surface of the country, and from the gravel of the boulder drift which fills up many of the hollows.

Whatever those structures may have been intended for, they are evidently of considerable antiquity, and have for a long time been disused, for through the centre of many the pine, the oak, and the arbutus have grown up and attained to full growth. Recently a number of these mounds have been opened and examined by the members of the British Columbia Natural History Society, and whilst some did not contain anything, in others remains of human skeletons were found, so it has been concluded that the circles were places of sepulture of an extinct race, as the natives found in the country by Captains Cook and Vancouver could not give any explanation regarding them.

In the succession of its seasons and general thermal conditions the climate of Vancouver Island approximates closely to that of Great Britain. Its situation being close to a continent, the mountain ranges of which are capped with perpetual snow, and surrounded by an ocean remarkable for its extremely low temperature, certain local peculiarities present themselves, and these are specially marked at the south-east end of the island, owing to its proximity to the Olympian range of mountains in Washington State, across Fuca Strait. That range, which runs east and west, presents its northern aspect to Vancouver Island, and as on this

aspect the snow remains on the mountain peaks all the year round, the winds which blow from that direction are occasionally cold and chilly.

On a clear, summer day, when the direct rays of the sun are scorching, and labour or exercise on the dry and heated surface of the earth is overpowering, a gentle, southerly breeze may be blowing—so gentle as not to make itself felt, yet so cold as to make the heated traveller long for an extra covering if he seeks the shade. In like manner to the hot day succeeds the cold night. The heat obtained from the calorific rays of the sun during the day is quickly radiated from the surface of the earth, and down from the mountain peaks comes, creeping, the heavy cold air to spread itself over the surface of sea and land.

The winter season in Vancouver Island may be characterised as open and wet. There are exceptional seasons, but from the middle of November until April rains are frequent. During this period the appearance of the landscape is gloomy. The sombre, dark green foliage of the pine throws a heavy shadow on the bare rocks; the warm brown carpet of fern has in a great measure disappeared; the bramble has died down; the thickets of rose, of raspberry, and of sweet briar are but naked skeletons, and nothing is left to gladden the eye but the graceful clusters of the wax-like snowberry, contrasting with the beautiful green of the young and springing pines.

Winter begins to disappear in the month of March, and bursting from the teeming earth with the first warmth of spring and early summer numerous bulbous plants raise their beautiful heads, arrayed in the loveliest colours, to welcome the coming season. "The delicate lilac petals of the *Kamass*, the beautiful *Collinsia*, with its starry eye, bringing to remembrance the Forget-me-not of the old home, the graceful *Trillium* in its glossy setting of dark green leaf, and amongst the broken rocks and gnarled roots of trees, springing lightly on its delicate stem, the graceful, drooping *Erythronium*, or dog-tooth violet. The wild *Ribes*, with its scarlet blossom, gives early evidence of life, and amongst the dead leaves of a bygone year smiles a bright encouragement and welcome to the opening buds. The spring grass and young shoots of the fern give a covering of tender green to the earth, over which during the dark months of winter the solemn pine has been brooding; the oak unfolds its leaf, the maple gently opens into day, the willow, alder, and aspen fill the hollows with their yellow-green light, the gooseberry and the currant, the raspberry and the rose, in their native thickets burst into leaf and blossom." The writer from whom I quote the foregoing, and to whose descriptions I am much indebted, further remarks: "Numberless minute but lovely flowers spring through the grassy carpet, or, in groups of rich and gorgeous colouring, irregularly scattered by Nature's hand, clothe the but now dead and naked rock with a bright mantle. The surface of the earth is teeming with life, and the air is redolent of the odours of a thousand blossoms, and the face of the whole country sweeping on in graceful undulations, is literally 'a garden of roses.'"

In the months of June and July vegetation attains its most vigorous growth, and its progress is most remarkable. In August and September the want of rain begins to be felt, the summer heats parching the ground

and scorching the pastures. After the break of the season the fine weather of the later autumn (the Indian summer) sets in, and the mellow tints on leaf and spray give the chief charm of the year to the lovely landscape, while they proclaim that its beauty is for a time about to pass away. The autumn of the American climate is finer than that of the European, and the fine weather (the Indian summer) extends further into the year. The winter months, in ordinary seasons, are much the same as in the west of England; in the severer and exceptional, like the Midland counties and east coast of Scotland.

Northerly winds occasionally prevail, and, for such a latitude as Vancouver Island, are quite exceptional in their character, being hot and dry. Blowing gently from the north, they sweep over the land heated by the rays of the summer sun, and gathering fragrance in the pine woods as they pass, they fill the air with a transparent haze, and give an almost tropical appearance to the landscape. The prevailing winds during the summer months are from south-west and north-west—blowing freshly during the day, the nights being tranquil and clear.

The geological structure of Vancouver Island, owing to practical difficulties, can only be arrived at by deductions from partial observations, such as are afforded by sections on the coast, by ravines, water-courses, and mountain summits. It is impossible in the summer months to penetrate the valleys, covered by a thick vegetation, to any good purpose, and in the winter months the task is too arduous, if not impracticable. Enough, however, is known and apparent to show the general geological character of the island. All geological evidence tends to prove that the last upheaval of North America and the outlying islands in the Pacific was slow and gradual, occurring in the Post-Pleistocene or most recent Tertiary epoch.

Vancouver Island and its dependencies or outlying islands form a barrier against the powerful effects of the violent storms which rage along the coast in the later autumnal and early spring months, together with the sweeping currents, which, rushing irregularly in all directions, carry everything but the hardest rocks before them. Without such protection as is thus afforded, the loose, friable materials from Burrards Inlet southwards must have been long since swept away. Acting, therefore, as a protecting barrier, an axis of metamorphic gneissose rock is found in the south-western extremity of the island, having above it clay slates and Silurian deposits, or, at all events, rocks of the Palæozoic age. A black, bituminous-looking slate is brought from that locality, as also from Queen Charlotte Islands, which is used by native Indians in making carved ornaments.

"A great deposit of clay slate has existed along the whole south and west, but, shattered and broken up by intruded trappean rocks, it has been almost entirely removed by the subsequent glacial action which grooved and furrowed the dense crystalline felspathic traps. Masses of lenticular or concretionary limestone are interspersed throughout this formation, and afford good lime for economic purposes. Along with the traps, other rocks of igneous origin have been erupted, and at the Race Rocks a remarkably beautiful dark green hornblendic rock is found,

studded with large and perfectly formed crystals of quartz. The sedimentary rocks are—carboniferous sandstones and grit, limestones and shales, of both the Cretaceous and Tertiary ages. These in patches fringe the whole coast from the extreme north, round by the Strait of Fuca to Nootka Sound, and enter largely into the formation of the numerous outlying islands in the Gulf of Georgia.

"As shown by the associated fossils, the coal-field of Nanaimo is of Cretaceous age—the whole deposit has undergone many changes of level, numerous extensive faults existing. Upheaval, subsidence, and denudation had all done their work on the dense crystalline rocks of the axis of the island, and on the Cretaceous beds of Nanaimo, long before the Tertiary sandstones and lignites were elevated by the slow upheaval of the Post-Glacial period. Associated with this coal-field, and scattered over the neighbouring islands, are numerous nodules of septaria, a calcareous clay charged with iron, of great value as a hydraulic cement. Copper pyrites and peroxide of iron are found in various localities giving promise of mineral. At Barclay Sound, on the south-west coast, in the metamorphosed rocks of that locality, another pyritic ore of copper has been found, as also at Cowichan on the east coast. Traces of gold are to be found in the clay slates and permeating quartz veins, disseminated in fine particles throughout the mass, and also as auriferous iron pyrites."

Mining for gold has not as yet been carried on to any great extent in the island. The same may be said respecting copper and iron. Of coal and coke the British Columbia Board of Trade annual report just issued says:—"The output of 1,135,865 tons of coal for 1898 was the largest on record. The exports were principally to California, 765,686 tons, but other shipments went to Alaska and the Hawaiian Islands. The Vancouver Island coal maintains its hold on the California market, and still represents about one-third of the imports to that state. The total number of hands employed in coal mining in 1898 was 2841. The Vancouver Island collieries produced about 35,000 tons of coke, which was mostly used for smelting purposes; 3167 tons were exported."

It is unfortunate that the iron deposits are not properly developed. It is believed that some properties offered as iron mines will be found to contain copper when thoroughly exploited. There have been inquiries for iron recently. A gentleman connected with an iron mine near the east coast of Vancouver Island writes to a Victoria, B.C., paper, the *Colonist*, a few days ago, and says:—"In Victoria some of the most influential people were hard at work at the time of the writer's visit in an effort to induce British capital to invest in iron and steel industries on the island. The Government of British Columbia has passed a law providing for a bonus of $2 for every ton of pig-iron, and $4 for every ton of finished iron and steel which may be produced in the province."

There is no question that the necessary raw materials for the production of pig-iron can be found in British Columbia. On the eastern coast of Vancouver Island, and just north of the 49th parallel, at Nanaimo, there are large coal-fields which have been opened up, and are producing bituminous coal which is well suited for coking. From Nanaimo there is a railroad extending south-east to Victoria. In

several other places on the island good deposits of coal have been found.

Iron ore of very rich quality has been found in a number of places. Probably the best and most accessible deposits are to be found on certain islands in Barclay Sound, which is on the south-west coast of Vancouver Island, and only about fifty miles over the water from the nearest point of the State of Washington. In the Straits of Georgia, which separate Vancouver Island from the mainland of British Columbia, are Texada and Redonda, which contain good deposits of iron ore. On the coast of the mainland, at Rivers Inlet north of Vancouver Island, are also deposits of ore.

On Tzartoos Island, in Barclay Sound, where, as has been said, are the most accessible deposits, there is a mine already opened up, which the writer visited. On that island is a peak about 1000 feet above sea-level, which, to a distance of about 150 feet from its top, seems to be a mound of solid iron ore. At a lower point, where the hill is about a mile in circumference, a heading is driven into the hill for about 50 feet, and is about ten feet wide. The writer has a number of specimens which he secured from this heading. The ore is granular and magnetic, with thin veins of limestone running through it. The foot of the hill is about 600 feet from deep water, and the lie of the land is such that a wharf could be built so that large ocean steamers or scows could be brought up to a position where the ore could be dumped down a chute and fall directly in. It has been estimated by experienced mining engineers that this deposit contains about five million tons of ore. Of this ore there are given below six analyses, made as follows: No. 1, by Mr. Dewsnap, mining engineer and chemist, at Seattle, Washington; No. 2, by the Government office at Vancouver; No. 3, by the Cleveland Steel Works, at Middlesborough, England; No. 4, by Dr. Otto Wuth, Pittsburg; and Nos. 5 and 6, by Mr. G. M. Godspeed, chemist of the National Tube Works, M'Keesport:—

	1	2	3	4	5	6
Iron, . .	64·00	64·01	66·60	66·62	67·98	69·160
Silica, . .	7·35	...	2·00	...	2·67	1·500
Alumina, .	0·52	...	...	0·14	...	...
Sulphur, .	0·0054	0·008	0·02	0·006	Trace.	Trace.
Phosphorus,	0·0071	0·01	0·01	0·003	0·008	0·007
Lime, . .	3·76	...	4·00	...	3·000	0·250
Manganese, .	Trace.	...	...	...	0·250	0·160
Magnesia, .	...	...	...	...	1·150	0·120

"The duty on iron ore imported into the United States is 40 cents a ton, but the freight charges would be light, as it is only a short distance by water from Barclay Sound to a point on Juan de Fuca Strait on the American side. The cost of mining would be light, as all the deposits mentioned as being near tidewater are above sea-level, and they could be mined by the steam shovel, some of them requiring stripping. The ore could be conveyed into a chute which would carry it to the steamer or scow in the quiet water of the sound, and there is only a short distance of open sea which the scows would have to traverse to reach Juan de

Fuca Strait, and this could doubtless be made by suitable scows in quiet weather. The owners of the Barclay Sound mine state that the ore could be delivered duty paid on the American side for $1.55 a ton."

The most remarkable feature in the geology of the south-eastern end of the island is the scooping, grooving, and scratching of the rocks by ice action. The dense felspathic trap already spoken of is ploughed into furrows six to eight inches deep and from six to eighteen inches wide. The sharp peaks of the erupted, intruded rocks have been broken off, and the surface smoothed and polished, as well as grooved and furrowed, by the ice action on a sinking land, giving to the numerous promontories and outlying islands which here stud the coast the appearances of rounded bosses, between which the soil is found to be composed of sedimentary alluvial deposit containing the débris of Tertiary and recent shelly beaches, which have, after a period of depression, been again elevated to form dry land, and to give the present aspect to the physical geography of Vancouver Island.

"As might be looked for in a country so marked by glacial phenomena, the whole surface of the land is strewed with erratic boulders. Great masses of many tons weight are to be found, of various igneous and crystalline as well as of sedimentary rocks, sufficiently hard to bear transportation and attrition. Granites and granitoid rocks of various descriptions are to be met with; trappean rocks of every kind, from whinstone through the whole series—mica-schist with garnets, breccias, and conglomerates. From these granitic boulders, and from the sandstones of the outlying islands, valuable building material is obtained, some of the grey granite equalling in beauty and closeness of crystalline texture the best granites of Aberdeen or Dartmoor."

The general lithological character of the whole island may be described as follows:—Amongst the metamorphic and intruded rocks are gneiss (gneisso-granitic), killas or clay-slate, permeated by quartz veins; quartz and hornblende rocks; compact bituminous slates; serpentine; highly crystalline felspathic traps (bedded and jointed), semi-crystalline concretionary limestone. Amongst the sedimentary are sandstones and stratified limestones crystallised by intruded igneous rocks, carboniferous sandstones, fine and coarse grits, conglomerates and fossiliferous limestones, shales, etc. etc., associated with the seams of coal.

While the last upheaval of the land, which took place at a geologically recent period, failed to connect Vancouver Island with the North American continent, it at all events was sufficient to effect, to a great extent, the junction of numerous insular ridges, and thus to form a connected whole of what had been and might have continued only to be an archipelago of scattered islets. The upheaving force elevated and connected those, and brought to the surface the great clay gravel and sand deposits of the northern drift, which had swept over and been deposited on the submerged land. These sands, gravels, and clays were now to form the surface soil of land prepared in a measure for the use of man. These constituents of the drift remain in many parts thinly covered by a coating of vegetable mould, but much of it has been washed away. The clay remains most generally and widely spread out as a retentive subsoil,

having resting upon it a thick coating of vegetable mould. The most valuable soil is found sweeping down the sides of gentle slopes, filling up hollows and swampy bottoms, and, mixed with the rich alluvial deposits of such districts as Saanich, Cowichan, the delta of Nanaimo, and Comox, forms an almost inexhaustible source of agricultural wealth.

From its insular character and peculiar physical formation, Vancouver Island possesses abundant means of water carriage, as inlets and arms of the sea run up to its most fertile valleys and supply the place of navigable streams. There are no rivers in the stricter sense of the word, such streams as flow through the country being simply the short water-courses which discharge the overflow of lakes or the surface water of the neighbouring ridges—torrents in winter, nearly dry in summer, valuable only as a power for driving machinery, and possibly at a future day to be rendered useful by means of irrigation, a process by which many parts of the country would be much benefited.

Stretching into the heart of the country, lying along the bases of the parallel ridges of trappean rock, are numerous lakes, in some cases forming a continuous chain; others, solitary, lie embosomed among the mountains, and form a beautiful feature in the landscape—placid, clear, and calm they lie among the rocky, pine-clad hills, fringed by the willow, the alder, and the trembling aspen, the tender green of the foliage brightly yet softly reflected in the sunshine from the watery mirror, while stretching across as if to grasp the light, the dark purple outline of the shadow of the frowning peak envelopes the further side in gloom.

It may be found interesting and useful to refer to the principal points along the coast of Vancouver, together with some of the agricultural districts. From Port San Juan, near the entrance to the Strait of Fuca, to Sooke Inlet there is scarcely any settlement. At Sooke there are several good farms, and farmers bring the produce to market by a public road constructed and maintained by the provincial Government.

Esquimalt harbour and Victoria harbour have already been referred to. Connected with the latter there is a scheme proposed by which the harbour is to be enlarged and deepened at an estimated outlay of five million dollars. The proposal is to remove rocks and shoals, and to excavate an area of about 167 acres to a depth of thirty feet at low water, enclose it with a wall built up of the rocks now impeding navigation, and fill the balance behind with the excavated waste material, and thus reclaim about 109 acres of land that would become some of the most valuable property in the city. This reclaimed land in the upper and lower harbour would altogether have a frontage towards the water of about five miles. The engineer and projector (Thomas Sorby) has been voted $600 by the Victoria City Council towards the expense of proceeding to Ottawa to interview the Dominion Government on the subject. His views have been favourably received. Another proposal is before the City Council, viz., to have certain mud flats at James Bay, near the new parliament buildings, filled in, and a new bridge constructed to replace that now in use.

Saanich peninsula is formed by Saanich Inlet, the south end of which extends to Goldstream station of the Esquimalt and Nanaimo

railway. The waters of Goldstream connect by "the Gorge" with Victoria harbour. The Victoria and Sidney railway runs along the peninsula to Sidney on its north-east corner, where it connects by steamer to Nanaimo. Captain George Henry Richards, of the Admiralty survey, in 1857 described the peninsula "as forming the south-east portion of Vancouver Island, of about twenty miles in a NNW. and SSE. direction, and varying in breadth from eight miles at its southern part to three at its northern. On the southern coast of this peninsula are the harbours of Esquimalt and Victoria, in the neighbourhood of which, for some five miles, the country is pretty thickly wooded, its prevailing feature—lake and mountain, with some considerable tracts of clear and fertile land. The northern portion for about ten miles contains some of the best agricultural land on Vancouver Island. The coast-line is fringed with pine forests, but in the centre it is clear prairie or oak land, much of it under cultivation."

Cowichan valley, including Comiaken, Quamichan, Somenos, and Shawanigan, combine the characteristics of the fertile valleys and prairies which fringe the eastern coast. The valley may be considered to be about fifteen miles' ride upon the sea-coast, narrowing rapidly in a westerly direction to the width of about six miles. It is bounded by high ranges of mountains composed of calcareous sandstones, which form almost impassable barriers to the valley on the north and south. To the disintegration and decomposition of these rocks, all highly charged with carbonate of lime, is due the distinctive character of the soils throughout the Cowichan valley. In their nature they are essentially calcareous, for while other constituents occur in different proportions, in this locality carbonate of lime almost invariably predominates.

Of this soil there is usually a good depth of from two to three feet, resting on a sufficiently retentive subsoil of blue clay or gravel. The earths, chiefly light, very porous, and composed of due proportions of clay, sand, carbonate of lime and humus, are well constituted for absorbing and retaining moisture, and the general colours from brown to black, with the entire absence of chalky or white earths, would likewise indicate a favourable soil for receiving and retaining heat.

Samples taken from the Somenos plains were found by experiment to absorb water sufficient to increase the volume of soil from one-fifth to one-eighth of its whole bulk. Much of the soil along the river bottom is a clay loam of a brown colour, and is excellent for wheat, beans, turnips, and red clover. The alluvial deposit of the valley is, however, far from being all of a clayey nature; in many parts, chiefly on the southern side, the mould rests upon a gravelly, and even a sandy substratum. This is likewise a rich soil, as may be seen from the abundant crops of potatoes, one of the most exhausting of plants, raised by natives on the same patches of land for a series of years.

The soils on the prairie lands are either gravelly or sandy and gravelly loams suitable for barley, oats, rye, buck-wheat, beans, peas, root and leaf crops, potatoes, turnips, carrots, and the usual garden vegetables. Wheat may be successfully raised upon most of the soils, and with proper tillage upon all. The humidity of the atmosphere at

certain seasons may prove a barrier to the cultivation of Indian corn, but there is every probability that grain will one day form a staple, as it will assuredly be a profitable, commodity both of consumption and export. In recent years it has been found that with judicious selection of seed, and not planting too early, good crops of Indian corn can be raised in Saanich, Salt Spring Island, and Comox.

The species and variety of plants growing in those rich and fertile districts are numerous; growing on the meadow lands are the following:— "White pea (five to six seeded), wild bean, ground nut, a species of white clover, reed meadow grass, bent spear grass, wild oats, wild timothy, sweet grass, cowslip, crowsfoot, winter cress, partridge berry, wild sunflower, marigold, wild lettuce, nettles, wild angelica, wild lily, brown leaved rush."

The chief economic woods are the oak and pine. The following list comprises a general summary of the trees and shrubs met with:— "Oak, red or swamp maple, elder, trailing arbutus, crab apple, hazel, red elder, willow, balsam poplar, various species of pine; balsam fir, cedar, barberry, wild red cherry, wild blackberry; yellow plum, choke cherry, black and red raspberry, white raspberry, prickly purple raspberry, prickly gooseberry, swamp gooseberry; several kinds of currants; bear berries, mooseberry, snowberry, blueberry, bilberry, cranberry, whortleberry, red and white mulberry."

Situate eastward from the districts described is Admiral or Salt Spring Island, which is exceedingly fertile and well settled. The brine-springs on the island have been ascertained by analysis to contain 4994 grains of salt per imperial gallon. Admiral Island has two good ports, which are visited weekly by the steamer plying between Victoria and Nanaimo.

From the north end of Admiral Island to Nanaimo there are about twenty miles of coast-line guarded by a chain of islands, between which and the main island are numerous passages, through which the tides course like torrents. The more remarkable of these are known as the "Narrows." Nanaimo harbour is thus described in the *Sailing Directions*: "When the banks are covered, this harbour gives the idea of a large sheet of water, but the deep part is limited, although there is plenty of room for a considerable number of vessels moored."

The coal-fields adjacent to, and under, the harbour, are composed of coarse grits, sandstones, and shales.

The whole deposit, which, from the associated fossils, is shown to be of the Cretaceous age, has undergone much disturbance from the action of volcanic forces in the neighbourhood. Faults are very numerous, and the members of the sedimentary stratified rocks are disturbed and twisted about in a very remarkable manner. Nanaimo is situated about seventy miles from Victoria by sea. The Esquimalt and Nanaimo railway now runs from Victoria to Wellington, where the Dunsmuir mines are, a few miles beyond Nanaimo.

The country surrounding Nanaimo has been divided into the mountain, cedar, and cranberry districts, these names having reference to the character of each. The mountain district contains 16,000 acres. As

its name implies, the general character of the region is mountainous and broken. Crown mountain, connected with this district, although some distance north of Comox, rises to the height of 6082 feet. Numerous other mountains of considerable elevation (Mount Arrowsmith, 5900 feet, etc.) rise along the axis of the island, but many of them are not even located on the maps, or named yet. The only good land lies along the stream known as Millstone river; the grazing, however, is excellent, and the timber, large and small, of the best possible quality.

The description given of the Cowichan and associated districts applies to the cranberry, cedar, and delta plain divisions of this region, the fertile soils being in this case arenaceous loam, and, on the delta plains of the Nanaimo river, vegetable mould of great depth. Nearly the whole of the cedar district, which contains about 11,000 acres, is available for cultivation, and contains some very rich land. "The climate very nearly resembles that of Victoria, the general character of the summer being warm, with little or no rain, but heavy dews; and that of the winter mild, with an average perhaps of ten days' snow; the frosts, though not severe, are of longer continuance. Rain falls in considerable quantities in the spring of the year, and it is generally thought that the average fall exceeds that of England."

The valley of Comox, another fine agricultural district, estimated to contain 300,000 acres of arable land, lies to the north of Nanaimo. It is being rapidly taken up, and produces excellent crops, in fact it is looked upon as one of the best districts on the east of Vancouver Island. The Union coal mines and coke kilns (Dunsmuir property) are situate in this romantic region. The war ships at Esquimalt have their target range off Comox harbour, where they rendezvous for practice at stated intervals each year.

Proceeding north and west, passing Valdes Island and through Johnstone Straits, an excellent route for steamers, abounding in good anchorages, one reaches the extreme north-east point of the island, at Fort Rupert and Hardy Bay. At the latter place there is an excellent harbour, which, it is expected, will soon be utilised by appropriating the surrounding land for settlement, and a town site for manufacturing purposes—saw mills, pulp mills, salmon cannery, etc. At Alert Bay, near the outlet of Nimpkish river, there is a salmon and a clam cannery. A few miles farther on Port M'Neill is passed. The carboniferous formation met with at Nanaimo continues to the east side of Hardy Bay, but follows the west side of the harbour and across the country to Cape Scott. The coast along to Cape Scott is flat and the land unsettled.

The western coast of the island, commencing at Cape Scott, possesses a number of remarkable and interesting features. From the cape a group of islands extends westerly for forty miles. It is composed of three large and several smaller ones, "which are high, conical, bare, ninepin rocks." Triangle Island, the westernmost of the group, is a very remarkable bare island 1000 feet in height, having a curious notch on the summit. Between the cape and the nearest islands there is a good clear passage of two or three miles wide. There is excellent fishing in this passage—halibut, cod, etc.

From the group referred to, off and round the coast, southerly, towards Woody Point, "is a bank exactly similar to one which, lying off the entrance of the Straits of Fuca, stretches northerly to near Nootka Sound, and southerly to below the 48° parallel on the coast of the main continent. A middle ground of deep water, extending from Woody Point to below Nootka, separates these banks, which extend westerly to 125° and 126° of W. long., with an average depth of water of from 40 to 100 fathoms, having a gravel or sandy bottom in the shallower, and blue mud in the deeper, parts. These banks get shallower as they stretch westerly, and terminate abruptly at a sharp ridge, beyond which there are no soundings." Both at the north-west and south-south-east extremities of the islands, these banks abound with cod and halibut, and are said to be steadily fished over by United States fishermen without distinction of *meum et teum*. A southerly current prevails along the whole west coast, and often sends ships south of their reckoning.

Immediately south of Cape Scott is Quatsino, an important inlet, with three arms, stretching nearly across the island to Fort Rupert, on the eastern side. A Government trail has been made from Rupert Arm, near Coal harbour, to Hardy Bay. The whole of that country is underlaid with coal. A company is now engaged in exploiting a mine at Coal harbour, and another has applied for a charter to build a tram-railway to Hardy Bay as the best shipping point on the north of Vancouver Island.

"The natives at Quatsino are said to be more primitive than those in any other part of the island. In 1862 they numbered 528, but are diminishing yearly." (In 1898 official returns give 144.)

"Woody Point separates Quatsino from Kyuquot, a district which extends to Nootka Sound. The natives here are very numerous (1862), but were more so a few years ago. There is a feud between them and the Nootka tribe, who have killed a great many of them."

Nootka Sound is a deep inlet possessing few harbours or good anchorages. The small harbour or cove at its entrance is famous as the scene of the Spanish occupation dispute, and an anchorage nearly opposite has a special interest as having been Captain Cook's. The Nootka tribe numbered (in 1862) about 457 in all. (In 1898, reported 257.) Along the whole coast every promontory and bit of level land bears marks of old occupation (a great depth of clam shells), indicating a very numerous population at one time, though the well-known migratory habits of the people must be taken into account.

"Clayoquot Sound differs from all the other inlets of this coast. Its entrance is full of banks and shoals of sand and gravel, instead of a deep muddy bottom. The narrow arms more resemble the neighbouring sounds except in geological feature. A gneisso-granitic rock (metamorphic) forms the axis of elevation, associated with which are hornblende and coarse-grained quartzose rocks, intruded traps, and quartz veins, indicating a region most probably rich in mineral wealth."

"Barclay Sound, situated close to the entrance of Fuca Straits, has a very important position. A somewhat open sound, studded with numer-

ous islands, it possesses several good anchorages, one very convenient to the entrance at Cape Beale. On this cape a lighthouse has been erected. It is connected by telegraph with Victoria. At the upper end of the sound a very remarkable cleft in the mountain ranges, known as Alberni canal, leads, after a course of twenty-five miles, to a level country of considerable extent, heavily timbered with the finest specimens of pine and other woods perhaps anywhere to be seen. Through this 'canal' flows a stream discharging the waters of a chain of lakes which penetrates northerly into the interior. The anchorage is good, and the whole sound, canal, and harbour can nowhere be excelled for the facilities they afford for the promotion and protection of commerce. The natives (in 1862) numbered about 800 or 900 (in 1898, official report gives 196); and here as elsewhere their sole occupation is obtaining food. In 1856 there were over 24,000 Indians on Vancouver Island. The official returns for 1898 show a remnant of only 5395."

A few miles farther south the Indian village of Nitinat is reached. It is situated on a large lagoon, has a number of native residents (official report, 1898, gives 215) and a Methodist Church missionary. There are no agricultural settlers, although some excellent land surrounds the lagoon. A few more miles south brings us to Point Carmanah, opposite Cape Flattery, where the Dominion Government has established a lighthouse and telegraph office, which connects with Port San Juan and other points along the coast to Victoria. This brings the coast sketch along to San Juan, the point of commencement. The interior of Vancouver Island is not as yet explored in some places, and settlement is very scanty, except in the sections referred to in the consecutive descriptions.

FROM LONDON TO KARACHI IN A WEEK.[1]

By Francis H. Skrine, I.C.S.

An impartial history of the last of the many conquests which India has undergone remains to be written. We of the present day cannot appreciate the import of those events which gave our great-grandfathers an empire in the East to compensate them for losing the overlordship of the North American continent. The merchant adventurers who became sovereigns in despite of themselves were our kinsmen and of like passions with us: and remote posterity must be left to judge their actions.

The Gibbon of a future age who shall describe the growth and decay of British India will not omit to consider the means of communication

[1] This article reproduces a lecture read in June last before the members of the Anglo-Russian Literary Society.

which enabled the people of a group of islands far in the Northern seas to govern hundreds of millions of their fellow-creatures, denizens of the tropics. We have heard, perhaps, a little too much of Sea Power—one of those catch-phrases in which latter-day journalists revel—since Captain Mahan's great work revealed to the world the source and hidden springs of England's greatness. It is, however, not to be questioned that the command of the sea conferred on us by Nelson's victories alone enabled us to maintain a footing in India during the wars of Napoleon. In those now distant days the only route thither was by way of the Cape of Good Hope, a distance of nearly 12,000 miles. Navigators were at the mercy of the winds: and Indian fleets sailed under convoy, at a rate of speed regulated by that of the slowest vessel. Thus the best part of a year was occupied in the passage between Falmouth and Bombay. This state of things lasted for many years after the restoration of peace had left the sailor no other foes to contend against but the elements. My father, who sailed in 1840 for Bombay with a detachment of the old 78th Highlanders, spent seven months on the ocean wave, now lashed to fury by a cyclone and anon rocking the yards of the wall-sided transport under in its heavy swell.

In the following year he returned to England by the then novel Overland Route, in about forty days. The story of this second stage in the development of our communications with India has been often told, but I must repeat it, very briefly, in order to give you a consecutive account of the process. Late in the "twenties" the superiority of steam as a propellant in ocean navigation was admitted even by that fine old crusted monopolist the Honourable East India Company: and Government offered a premium of £20,000 to the first commander who should pilot a paddle-ship from Europe into an Indian port. The problem brought Lieutenant Waghorn to the front—a man of one idea, with the dauntless perseverance which is the special gift of such natures. He pointed out that as steam had robbed the Red Sea of its terrors for the navigator, it was perfectly possible to revive the ancient trade route to India by way of Egypt, and thus save nearly 6000 miles of ocean transit. The doctrine met with the reception usually given to innovations. For years Waghorn knocked in vain at the doors of the Admiralty and the India House. At length his persistence met with a rich reward. In 1838 the mails were carried home by way of Suez and Trieste in vessels of the Royal and Indian Navies: and in 1845 the indefatigable lieutenant arrived in London with the Bombay post-bags after a thirty days' journey.

The French Government was fully alive to the advantage of directing the stream of Indian traffic through its territory, and strove successfully to render Marseilles the port of debarcation. Railways had become pretty general by 1850: and at that date the mails were carried to India in about a month. But Egypt was still unspanned by an iron road, and passengers by the Overland Route were whisked through the desert in conveyances apparently modelled on bathing-machines. The defects in the existing transit arrangements were placed in a glaring light by the Mutiny of 1857, when immense loss of life, and what is

worse, of national prestige, resulted from the inevitable delay in reinforcing the attenuated British garrisons. On its suppression in 1858 a railway was constructed across the Isthmus of Suez to Alexandria. From this epoch, too, dates the prosperity of that splendid organisation the Peninsular and Oriental Steamship Company. It had rendered yeoman service during the crisis in India's fate, and was rewarded by the confidence of Government and of the whole Anglo-Indian community. And here let me pause a while to remark that no hostility to the time-honoured "P. and O." lurks in the Calais-Chaman railway project. I have travelled between England and India oftener than I can remember in its steamers, with unvarying punctuality, a very fair rate of speed, and a degree of comfort which is exceeded on no ocean line. There is ample room and verge enough in the route to India for railways and steamers side by side, and competition between the two methods of transit is out of the question.

But to return to our story of the development of communications with the East. In 1871 they were facilitated by the completion of the Mont Cenis tunnel and the substitution of Brindisi, at the extremity of the Italian peninsula, for Marseilles as the port of shipment for mails. In the same year a longer stride in advance was taken by the opening of the Suez Canal, which, in 1882, superseded the railway across the isthmus. These improvements, and the growth in the size and power of ocean-going steamers, have reduced the time of the journey between London and Bombay to seventeen days. But the Overland Route cannot be accepted as the last word in the science of Eastern travel. It has many grave and inevitable drawbacks. The sea voyage of fourteen or fifteen days, for the most part in tropical waters, is never exactly a pleasure trip, and during the monsoon it has terrors for all who are not accomplished sailors.

Fifty years ago these disadvantages attracted the notice of General F. R. Chesney, R.A., a man whose name would have stood as high as Lesseps' in the bead-roll of fame had the fates been kinder to him. He carried out a series of surveys of the Euphrates valley, and proved that a railway connecting the Mediterranean and the Persian Gulf was perfectly feasible from an engineering point of view, and was a thousand miles shorter than the Overland Route. He insisted, not without reason, that great political results would flow from an extension of British influence over southern Persia and Arabia. His views secured powerful support in London; and in 1856 a company was formed to give them tangible expression. The Sultan cheerfully granted a firman to the promoters of this grandiose project, and capital flowed into their coffers. At a critical moment, however, the susceptibilities of the French were aroused, and Lord Palmerston, deeming it essential to maintain the *entente cordiale* intact, imposed his veto on Chesney's plans. Posterity will, perhaps, indorse the masterful premier's decision. It is unquestionable that the track by way of Vienna, Constantinople, Asia Minor, the Persian Gulf, and Baluchistan is, in theory, preferable to all others. But the railway even now ends at Angora; and 2500 miles, most of which are irreclaimable desert, separate that terminus from Karachi. The cost of bridging

the gap would not fall short of twenty millions sterling, and the intermediate traffic would be inconsiderable.[1]

A final stage in the development of the means of Eastern travel has now been reached, and it rests with ourselves to hasten or retard its consummation. In ancient days the precious wares of the East—the silks, "gold, frankincense, and myrrh," so coveted by Roman grandees, reached the marts of Europe by way of Balkh, the Oxus, the Caspian Sea, and the Caucasus, emerging on the Black Sea at the fever-haunted port of Poti, formerly Phasis, which gave its name to the pheasants trapped in the surrounding forests. The revival of this old trade-route is due to General Annenkoff, a valued member of the Anglo-Russian Literary Society, whose recent death we have had occasion to deplore. He had great influence with his Majesty the late Tsar Alexander III. and his advisers, an influence gained by a long and brilliant career as a railway engineer; and a project framed by him for connecting the heart of Asia with the Caspian by rail secured powerful support. But there was a party equally strong which urged that no railway could be laid in the shifting desert sands, and advocated the canalisation of the Oxus as a preferable method of tapping the hidden wealth of Central Asia. In 1884, however, the conquest of Turkestan, and the acquisition by Russia of Merv, a point of vantage where three empires meet, put an entirely new complexion on the problem. The opposition to the Transcaspian railway slackened, and the Tsar gave his lieutenant a free hand. The story of his great undertaking is more interesting by far than the average novel, but space forbids me to attempt more than to sketch it in outline. In 1886 the railway was laid through the heart of the Turkoman desert to Merv; six months later the Oxus was bridged at Charjui; and in 1888 Samarkand re-echoed the snort of the Iron Horse. The economic results of this great trunk line surprised even its originator. Constructed originally for strategic purposes, it has long since lost its military character, and has become a main trade-route between East and West. No longer do caravans toil through Afghanistan and Western China, bringing tea and other luxuries dear to the Oriental heart from India and the Far East; and the sands between Bokhara and Orenburg are no longer traversed by interminable strings of camels, conveying cotton, dried fruits, and carpets westwards. The railway has caused a rapid and silent revolution, and in 1897 it carried a quarter of a million tons of valuable merchandise. So successful has been its working that branches have lately been constructed to Tashkhent, the Calcutta of Central Asia, to Andijan, near the Chinese frontier, and to Kushk, on the border of Afghanistan.

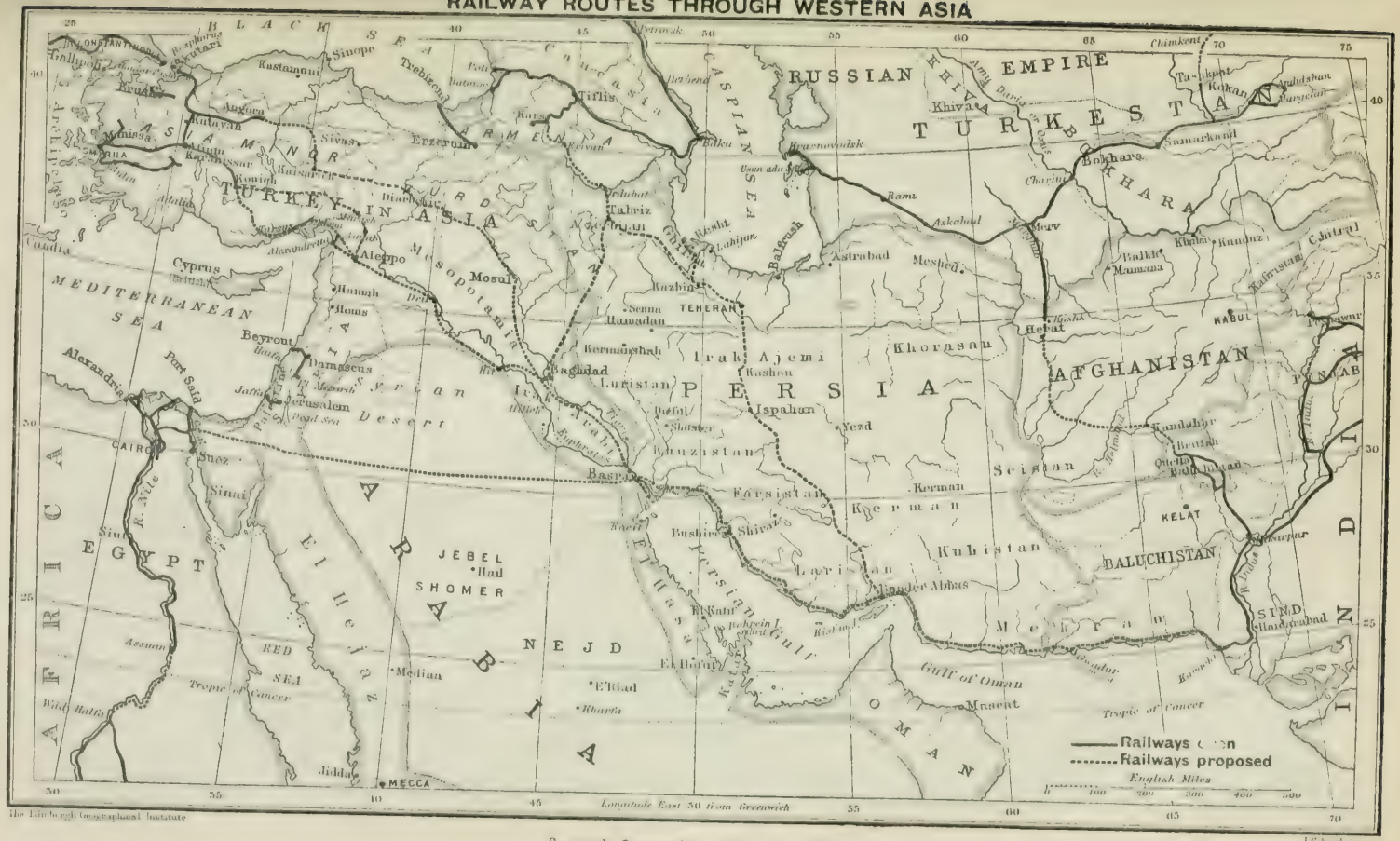
[1] I need not do more than allude to the various schemes which have lately been before the public for connecting Angora or Konieh with Bussorah at the head of the Persian Gulf. If some such line were constructed—a contingency rendered very remote by the jealousies of Englishmen, Russians, and Germans—it would undoubtedly open northern Persia to British trade. But as a link in our communication with India its value would be very small. Bussorah (Basra) is separated from Karachi by 1400 miles of the hottest waters in the world. The present Red Sea route is in every way preferable.

The completion of the latter offshoot, which runs almost due south from Merv, has brought the Russian railway system within fifty-four miles of the famous fortress of Herat, from which it is separated by the Parapomisus range, a line of low rolling hills easily traversed by wheeled vehicles. The Russian terminus is but 430 miles from that of our Indian railways at Chaman, on the southern border of Afghanistan. In other words, the gap between Russian and Indian railways is considerably shorter than the distance between London and Perth. The route lies by way of Sabzawar, Farrah, Girishk, and Kandahar, and presents no engineering difficulties of moment. I have it on the high authority of Colonel Stewart, C.E., now our consul at Odessa, who stands on the same level as our colleague Mr. P. Lessar as an authority on the geography of Persia and Afghanistan, that the Kushk-Chaman railway would involve no tunnelling or bridging to speak of. In estimating the expenditure involved, we have abundant data in the records of the construction of the Central Asian railways. They cost on the average £6,144 per mile, including rolling stock. On that basis the Kushk-Chaman railway might be built for £2,642,000; but allowing a fair percentage to cover unforeseen charges, we shall be well within the mark if we place the total at £3,000,000. This is not a very large sum in times when a single inland town can raise £15,000,000 for the purpose of securing water communication with the sea; and it is a mere flea-bite for empires such as England and Russia.

The results which would follow the bridging of this gap in our rail communication with India are positively startling in their immensity. A traveller India-bound might enter his corridor train at Calais, and, save for a few hours spent in crossing the Caspian, might travel without changing carriage to Karachi in a week. That this is something more than hypothesis is rendered clear by the following statement, prepared by my friend, Mr. Paul Lessar, which assumes the moderate speeds of thirty-two miles an hour on the European, and twenty-eight on the Asiatic lines:—

	Miles.	Hours.
London, Calais, Berlin, Alexandrovo, . . .	917	28
Custom Examination at Alexandrovo, . . .		1
Alexandrovo, Warsaw, Gomel, Merefa, Rostov, Petrovsk, Baku, ...	1968	63
Baku to Krasnovodsk (sea), ...	198	15
Krasnovodsk, Merv, Kushk, ...	714	30
Kushk, Chaman, ...	438	18
Chaman, Sukkur, Karachi, ...	481	19½
Total, ...	4716	174½

The cost of the journey would certainly not exceed that of a saloon passage to Karachi or Bombay by a first-class line of steamers. The rail-fare, if pitched at the level maintained on the *trains de luxe* which have rendered continental travel so easy, would not exceed £36, and the cost of food at £1 per diem would bring the total to £43. An opportunity would be given the Anglo-Indian traveller, the tourist flying



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from the rigours of a northern winter, of visiting realms which have hitherto been seen by few indeed of their race. The bazars of Bokhara, redolent of the unadulterated East, Samarkand, styled by Schuyler "a piece of another world," are no bad substitutes for the suffocating heat of the Red Sea, the dulness long drawn out of a prolonged voyage.

Now, a few words as to the political and economic features of this great project. The noisy but dwindling band of Russophobes will probably oppose on the score that it would be unwise to place our communication with India at the mercy of a Power which they are pleased to consider hostile. If there were any force in this argument we ought, *ipso facto*, to abandon the present mail route by way of Brindisi and Marseilles, because France may at any moment fly at our throats. We should still have our sea communication intact—a second string to our bow should the fates bring us into collision with Russia. But the danger of such a consummation would certainly be lessened by the proposed railway line. Englishmen and Russians are well able to appreciate each other's sterling qualities. On no occasion have they come together in social intercourse without the formation of life-long friendships. Such has been the experience of the Boundary Commissioners of 1885 and 1895. It was my own when, at the beginning of last year, I visited Central Asia, and was most hospitably entertained by General Kuropatkin, the present Minister of War, then Governor of Transcaspia. Of the assumed danger to our Indian Empire it is difficult to speak seriously. The geographical position of the peninsula renders it impossible that any European Power would reign supreme there which is not mistress of the seas. Though I am far from wishing to depreciate the Russian fleet, I venture to assert that extended sea power has never entered the programme of the Tsar and his advisers. Thus India is not, and never can be, their objective. But if it were, then Afghanistan must be the battle-ground for empire in Asia; and in that event it is ourselves rather than the Russians who would gain by the bridging of the gap between Kushk and Chaman. For our neighbours can now pour an overwhelming force into northern Afghanistan at a few days' notice, while in our case nearly 400 miles of trackless hill and dale lie between our railway base and the great citadel of Herat. Lastly, the exigencies of Central Asian commerce demand the linking up of the Central Asian and Indian railways, and if we decline co-operation the task of bridging the hiatus will assuredly be undertaken by Russia alone.

That the Amir Abdur Rahman would stop the way is in the last degree improbable. He is far too astute not to be aware of his position. The grain of wheat might as well protest against the impact of the upper and nether mill-stones as the ruler of the "Buffer State" oppose the settled policy of England and Russia combined. A railway through Afghanistan would be as inviolable as the Indo-European telegraph line which spans the wildest part of the Shah's dominions, and yet is never injured by the Kurdish tribes who have their eyries in those pathless hills. There is good reason to believe that the Amir of Afghanistan would bow to the inevitable and pocket the subsidy which would, of course, be offered as a *quid pro quo* for his permission to connect the uttermost ends of his dominions by rail.

There is, in conclusion, the economic aspect of the problem before us; but it is devoid of the complexity which clouds so many controversies in these latter days. People may ask how the Calais-Chaman railway could benefit *our* commerce, while Russia continues to hedge her empire about with a Chinese wall of protective duties, and aims at exploiting Central Asia solely in order to put money into the pockets of Moscow merchants and manufacturers. That the Tsar's advisers will ever become converts to the Free Trade gospel is indeed very unlikely; and *a priori* there is no reason why they should adopt its tenets. No subject, except perhaps currency, is so much talked and written about and so little understood, as Free Trade. The phrase has become a political parrot cry, a sort of Shibboleth, and is seldom examined critically by the light of sixty years' experience. The assumption on which the doctrine rests partakes of the nature of an axiom. Cobden and his school held that every community should concentrate its efforts on producing goods suited to its soil and climate and to the national genius of its people. These should be exchanged freely throughout the world; and no State has a right to enforce customs tariffs for aught but fiscal purposes. These views have been for two generations the corner stone of our commercial policy. But Cobden's horizon was that of the British Isles, and his sturdy insularity, a quality which he possessed in common with Macaulay and so many of the early Victorian giants, forbade him to recognise the fact that no two countries are governed by identical economic conditions. In the case of England, the growth of population has long outstripped that of the soil's productive powers. Seventy per cent. of her citizens depend on imported food, which must be paid for by products exported to foreign parts. If our self-governing colonies had nailed their colours to the Free Trade mast, if we had been able to establish a Zollverein linking every part of the empire by the only bonds which are strong and lasting—those of self-interest—then Cobdenism would have had a fair field. But our unnatural children are blind to their struggling, over-burdened mother's interests; and, for the most part, they hamper her trade by crushing protective duties. How can we expect foreigners to be more considerate in times when nearly every State appears to be bent on contesting our commercial and manufacturing supremacy? Different, indeed, is the condition of the broad realm of the Tsar! It is a world in itself, possessing every variety of soil and climate; and every idiosyncrasy to be found in the human race is seen in his myriad subjects. Thus, in spite of protection, Russia enjoys all the benefits of Free Trade. At the present moment the population of the valley of the Zarafshan, beyond Samarkand, suffers from one of the disadvantages involved by the acceptance of the dogma. They find food-grain at nearly prohibitive prices, because farmers have learned that cotton grown for Moscow mills pays better than wheat or millet.

But though England's voice is, and will long remain, that of one crying in the wilderness, signs are not wanting that Russia is about to enter on a fiscal policy more conducive to our interests. The change is foreshadowed in a remarkable speech by M. de Witte, the enlightened Minister of Commerce, a summary of which appeared in the *Times* about three months back. Russia, in fact, needs British capital, and is pre-

pared to make every reasonable concession in order to facilitate its inflow. Thus the time is a propitious one for a commercial treaty on the basis of the exchange, at low rates of duty, of products of which each empire possesses a natural monopoly. India grows many staples which cannot be reared in any part of the Russian empire—such as tea, coffee, indigo, jute, silk, tobacco, opium, and rubber. She is, on the other hand, a large customer for such Russian wares as petroleum, skins, carpets, and dried fruits. Hence the commerce of India would gain by the proposed railway line; while goods destined for Western markets might be carried through Russian territory in sealed wagons.

The realisation of this project, as remarked lately in the Allahabad *Pioneer*, would exercise a still greater influence on the moral and political development of India itself. The forty years which have elapsed since the Crown assumed the responsibility of governing her have worked a silent revolution in the minds of our dusky fellow-subjects. For good or for evil, they have absorbed the strong meat of our political literature, and demand all the privileges of citizenship with no uncertain voice. We can no longer be content, like the Moghuls, our predecessors in the thorny path of conquest, to camp in a subject empire, or to rest our supremacy on the bayonet alone. If the connection between England and her greatest dependency is to be maintained—if it is to survive the times of stress which are surely approaching—the two countries must be drawn together more closely, and communications between them must be speedier and more frequent than the close of the nineteenth century finds them.

The sketch-map shows the Anatolian railway ending at Angora and Konieh, the extension to Diarbekr and Bagdad, for which a concession has been granted, and the British scheme for a line to Adana, Hit, Bagdad and Basra, with the German project to carry it through Marash and Aintab. Farther east the Russian proposed lines are laid down from near Alexandropol to Tabriz and Bagdad, and from Enzeli to Bandar Abbas, the former of which will be commenced immediately.—Ed.

BRIEF NOTES ON THE GLACIAL PHENOMENA OF COLOMBIA (SOUTH AMERICA).

By R. Blake White, C.E.

1. Plateau Glaciers.

(*a*) Upon the summits of the cordilleras, at from 10,000 to 12,000 feet elevation, where the ground is relatively flat, with no neighbouring high mountains, extensive deposits of till are found, some covering over 100 square miles. This till is composed of clay, with sand and very angular fragments of rock—much of it quartz—and shows no sign of having travelled. Probably it has been left by ice-sheets having little motion. *Examples*—High lands of Anayma, SW. of Ibagué, Department of Tolima; high lands of Jicaramata, E. of Buga, Department of Cauca; great plateau of La Cocha, E. of Pasto, in the south of the Department of Cauca.

(*b*) At elevations of from 5000 to 8000 feet flat stretches of country,

with areas of 1000 to 1800 square miles, are covered with deposits of till of variable character. In some places it reaches a thickness of 300 feet, but is generally 40 or 50 feet thick. The till is composed mostly of red clayey earth, with subangular or rounded stones and boulders of all sizes up to 100 cubic yards or more. Irregular beds of sand and water-worn gravel occur, and great quantities of quartz. Most of this ground is auriferous, but irregularly so. In some places collections of huge erratics are found. Some seem to have been dropped in heaps, and others are piled up in ravines formed by the torrents of water flowing from the melting ice-sheets. Sketch No. 6 shows such a pile, and Sketch No. 7 a heap of erratics on high land. *Examples*—The Santa-rosa table-land, NW. of Department of Antioquia (this is more than 60 miles long by 30 to 40 wide); the Yolombó plateau, N. of the centre of Antioquia; the Remedios plateau, NE. of Department of Antioquia (Sketches 6 and 8); the Tuquerres plateau, south of Department of Cauca (this abounds in stony drumlins and huge erratics).

2. Mountain Glaciers.

(*a*) *Existing.*—At the present time I only know of glaciers on the Mesa de Herveo (Department of Antioquia), 17,500 feet; on the Nevado del Tolima (Department of Tolima), 18,750 feet; and on the Huila (Department of Cauca), 18,000 feet. These present the usual glacier features. Incipient glaciers exist in nooks and crannies on the Ruiz, Santa Isabel, Quindio, Moras, Puracé, Cocomico, Paletará, and Tajumbina, and away south near the Ecuador frontier on the volcanoes of Cumbal and Chilio.

(*b*) *Former Extension.*—Excluding debatable ground, it is quite clear to the observer that in former times all the mountains mentioned had huge glaciers extending far down into the valleys. The most notable of their traces are what seem to be ground moraines. These consist of immense masses of hard brecciated conglomerate, so enormous that one is at a loss to imagine how they can really represent ground moraine. But they extend right up to, and are lost under, the foot of the present glaciers, which by the way is hard to see, owing to the continual breaking away of the terminal ice front. On the eastern slope of the Puracé volcano near Popayan the ground is not very precipitous, and long ridges of moraines stretch down from the mountain to the valley of La Plata, forming the undulating grass lands of Moscopan.[1]

3. Ancient Valley Glaciers.

(*a*) *Lateral Valley Glaciers.*—Almost every considerable valley in the Colombian mountains had its glacier. No traces, or but faint vestiges, of the glaciers are found in those cases where the valleys have been subsequently cleaned out by the rush of waters from vanishing glaciers on the higher ground when the ice king was at his last gasp. A list of

[1] Owing to the well-known decomposition of the exposed surfaces of rocks in these countries ice striæ are hardly ever met with. Some scratched and grooved stones are found in the till, but they are rare.

such old glacial sites would comprise nearly all the river valleys of Colombia. Taking for instance the tributaries of the river Magdalena from Honda upwards, we have on the west side the rivers Guali, Lagunilla, Recio, Combeima, Coello, Cucuana, Tetuan, Amoyá, Saldaña, Paez, and La Plata, all with well-marked glacial deposits. A few examples will suffice to show their general character.

Sketch No. 1 shows the relics of the glaciers of the rivers Juanambú and Guaitara, with the volcano of Galeras near Pasto in the distance (S. of Department of Cauca). The inclined *mesa* or plateau in front is 2400 feet above the level of the Patia river, which receives the two rivers mentioned. The whole of this body of material is composed of glacial detritus, principally eruptive. Sand, till, boulder beds, felspathic clay beds and cemented conglomerates, sometimes with some pretence to stratification but mostly without, form this enormous mass. It rests, right down at the river's edge, on an old metamorphic rock. And what is seen in the sketch is only a patch. Away up the Guaitara and Juanambú and northward to the Mayo valley, 30 miles away, these *mesas* cover many hundreds of square miles of ground. Thirty miles or so up the Juanambú they flank the river with almost inaccessible cliffs of hard conglomerate more than 1200 feet high. The conglomerate contains everything from sand up to pebbles of 100 tons weight. Space will not allow me to attempt to describe the beetling cliffs, the huge tottering piles of disintegrated conglomerates, the rugged ravines guarded by hundreds of lofty rock-topped pinnacles, and the great blocks of uprooted breccias which form the wild ornamentation of this grand valley. It is the ancient field of a mighty fight between volcanic fire and ice, furrowed now by the work of time. When speaking of glacial lakes I shall have to refer again to these deposits.

Sketch No. 2 represents the old glacier field of the river Combeima, Department of Tolima. At the head of the valley lies the city of Ibagué. The river runs in a gorge 300 feet deep, shown to the left centre. To the left of this a side valley opens out. The head of this valley is a depression in the north ridge line of the Coello valley, and 2000 feet below it runs the river Coello.

In ancient times the great Coello glacier, whose thickness I have estimated at 5000 feet, overflowed through this gap, and, joining the Combeima glacier, produced the fine medial moraine shown in the sketch.

This glacier extended downwards from Ibagué some 25 miles, and probably ended in the Magdalena valley lake. Its base is formed of a hard conglomerate containing stones and boulders of all sizes, considerably worn. In the portion shown in the sketch it is 300 feet thick.

The Combeima river runs in a ravine of from 250 to 500 yards in width, with solid walls of this conglomerate on either hand. It is clear that so small a stream as the Combeima could never by itself have cut out this cañon. The work was probably done by the floods coming down from the melting glaciers above, carrying stones, etc.

The upper 15 or 20 feet of the deposit is formed of till, brick clay, beds of a marly felspathic earth, and löss. Most of the small streams

1.—Glacial deposits, 2400 feet thick, between the rivers Juanambú and Guaitara in the district of Pasto.

2.—Glacial deposit of the Combeima glacier, showing medial moraine.

3.—Outfall of the Rio Fraile glacier, with the Cauca valley (glacial lake).

4.—The Plains of Mariquita, Magdalena valley, showing denuded glacial deposits 900 feet thick.

that spring from the deposit have milky water, which no ordinary filtration can clarify. It is reputed to be very healthy to drink. The stream which runs down the edge of the valley to the right finds its way amongst huge boulders of syenitic granite, brought down from far above Ibagué. These probably represent the remains of the lateral moraine of the glacier. The streams of water from the melting ice carried away the lighter materials, and hence the bed of the present stream yielded great quantities of gold in Spanish times. It is said that on an average each Negro obtained about 30 oz. of gold per diem. The gold found here and above Ibagué, as well as in the Coello valley, is all rough and not worn at all, and carries much of its quartz matrix. It clearly was not brought down by water, and most likely took passage on the glaciers.

Sketch No. 3 shows the outfall of the old glacier of the river Fraile into the great Cauca valley. It explains itself. Here also the base is a hard conglomerate, and the upper portion is composed of marly earth and till with boulders. Very many of the loose boulders measure 125 to 150 cubic yards. The little drumlin shown is a heap of stony till.

The mountains in front are the Farallones of Cali in the Western Andes. To the left centre a valley with a sloping plain is shown. This is a great mass of stony till, mostly red clayey earth. It carries gold, and the Chontaduro mine is worked here. The gold is all rough, and not water or travel worn.

The city of Cali, seen to the right, is also built on an inclined plane of stony till, the outfall of the Cali river glacier.

I may mention here that in some river beds where the bottom gravel contains gold, the scales of metal are found so fast welded to the pebbles that the miners have to scrape them off. This shows the great pressure on the ground moraine.

(*b*) *Main Valley Glaciers.*—The valleys of the great rivers Patia, Cauca, and Magdalena, and those of all their larger tributaries, had their glaciers. Their deposits are too varied in character to be described here. They are constantly changed by local conditions. Confused at the junctions of side valleys, they become regular where the main stream took an even course. Many lakes were formed by ice jams. In some cases the ice was evidently held back until it found an overflow, or broke down an obstacle. In these instances *mesas* or plateaus composed of till, conglomerates, and breccias were formed and left in side eddies, or at the junctions of ice streams. Thus parallel roads were grooved out along the hill-sides, and these may be seen all over the country where the forest has been cleared away. In the valley of the Anayma on the Upper Coello these "roads," and the remains of lateral moraine drift left in the hollows of the mountain sides, give one the means of computing the thickness of the glacier. As already stated, the Coello glacier was 5000 feet thick, and must have exerted a pressure at its base of 120 tons per square foot. Would not heat be evolved by the movement (however slow) of such a mass, and might this not aid the formation of sub-glacial rivers?

Many instances occur where a great main glacier crossed the course of a lateral one, and by its weight drove the smaller ice-field uphill. In

the valley of La Plata a glacier carrying till with a peculiar red porphyry was driven up a side valley, and so over a gap into the Magdalena basin, where it left its moraines with the clearest evidence of the origin of the rocks composing them.

The medial moraines left by many of these glaciers, or the surface of the inclined plain of detritus, are often dotted in a more or less regular way with piles of clean angular stones, generally one or two feet in diameter, but sometimes larger. So artificially placed do these stones appear, that I was once inveigled into going a long way to see such a collection, which the country folk thought must be the work of some ancient race, and indicative of some great hidden treasure. The trip was instructive to me, but disappointing to my guides.

4. Glacial Lake Deposits.

(*a*) *Natural Lake Basins.*—The valley of Bogotá, 8200 feet above sea-level; the valleys of Guarue, La Ceja, and Retiro, in Antioquia (7800 feet); the valley of Cajamarca in the Cauca (5000 feet), and the valley of Urrao in the NW. of Antioquia (7000 feet) are examples of this kind of lake. Their outlets may have been to some extent blocked by ice, or the water from the melting ice when the glacier disappeared may have cut a channel deep enough to drain the depression, but at all events they were glacier lakes, and received contributions from the hills surrounding their basins. They exhibit deposits of clay, angular gravel, and rounded gravel, with travelled boulders, sometimes of large size. There are numbers of such lakes, big and little, in the cordilleras, and also small tarns.

(*b*) *Lakes formed by Ice Blocks.*—In the Magdalena valley there were at least four large lakes of this class. The lowest, covering the country round Honda, Mariquita, Lerida, and Ambalema, over an area of more than 800 square miles, was formed by a block of the ice coming down the Miel valley on the west, and of that coming down the Rio Negro valley on the east. These great ice-fields made a jam in the narrowest part of the main valley. Although Honda is only 656 feet above sea-level, there is no indication whatever of any subsidence having taken place which would account for the lake. If this had happened, the lake deposits would have extended down the valley below the confluences of the rivers Miel and Negro, which they do not. Into this lake flowed the great ice-streams from the valleys of the Guarino, Guali, Lagunilla, Rio Recio, and Combeima, all of them having their heads in the great volcanic chain which commences in the Quindio and Nevado del Tolima on the south and extends to the Mesa de Herveo on the north. From these volcanoes were poured out upon their glaciers such enormous quantities of lava, sand, pumicestone, etc., that, borne down upon the ice-fields to the lake, they there formed a fairly stratified deposit which covered upwards of 800 square miles, and which had a thickness (measured by me) of over 900 feet. Scarcely a trace remains in the valleys named of the passage of this marvellous amount of ejected material, and therefore it must have descended upon the ice.

When the glaciers finally broke up, the disappearance of the ice block released the waters of the lake. Deluges of water would then pour down into the lake below from the higher parts of the glaciers, and these powerful streams swept away before them the greater part of the lacustrine deposit, carving its remnants into the most fantastic shapes. Sketch No. 4 is a view looking north over the valley between Mariquita and Honda, which gives a good idea of this fine and undeniable case of denudation. All the hills shown have an average height of 900 feet above the plain. Bed rock is only to be seen on the edge of the Magdalena river, near Honda.

The second lake in the Magdalena valley was formed by the meeting of the glaciers coming down the valleys of the rivers Apulo, Bogotá, and Fusagasugá on the east, and those of the Coello and Cucuana on the west. The deposited material is principally red clayey till, with some boulders, and gravel at the base. Near Ortega the complete skeleton of a mastodon was found in 1887, and here also the denuded deposits take very remarkable shapes.

The third lake was formed at the junction of the Saldaña valley and the Magdalena. The deposits are better stratified, and large quantities of auriferous gravel are found. The denuding agents were less active, and the remains of the deposits have the form of long ridges with flat tops and rounded hills.

The fourth lake was produced by a narrow gorge in front of the town of Gigante (*giant*). The lake bed is covered with conglomerate, and this by till with many boulders. Numerous large erratics are scattered over the country. Mastodon bones have been repeatedly found in the till, and the popular idea regarding them gave the name to the town, Gigante. This lake was about 60 miles long by 30 miles wide in its broadest part. Its bed now offers to the view wide sloping plains, descending by terraces to the river, which cuts through the bottom conglomerate beds.

The immense deposits of the Guaitara and Juanambú region (Sketch No. 1) were no doubt semi-lacustrine. These rivers, joined to the Patia, flow through a very narrow gorge in the Western Andes, which must have held back the ice. I am not able to say to what extent water operated in the formation of these deposits, but no doubt it had a good share in the work.

The Cauca valley lake extended from Cartago on the north to Calote on the south, a length of 102 miles, with an average width of 15 miles. Its formation was due to its narrow outlet at the north end becoming blocked by the glaciers coming down from the Quindio mountains on the east, and those of the Tamaná range on the west. These glaciers have left abundant traces.

The lake appears to have been shallow, perhaps not more than 200 feet deep. The lacustrine formations consist of a bottom gravel, sometimes cemented, and beds of clay, yellow and brown sandy clays and marly earth. The thickness of these beds is about 40 feet. Following them comes a layer of vegetable soil from one to two feet in thickness, which I have traced over an area of more than 200 square miles. On

the top of this soil are beds of reddish earthy clay, sand, yellow sandy clay, and fine angular gravel or coarse sand. Erratic blocks of various sizes up to two and three cubic yards are found lying on the surface soil in many parts. This general class of deposit is varied locally by the till and gravel which were brought down by the glaciers of the lateral valleys.

The usual thickness of the lacustrine beds which overlie the substratum of vegetable soil is 25 feet, but it thins down in the centre of the valley to 4 or 6 feet. Everywhere this bed of soil contains abundant fragments of pottery of good quality and workmanship. Beds of semi-lignite, composed of the remains and roots of the *Guadua* (the South American bamboo), and of other common tropical plants are found in the soil. Mastodon remains are common in the upper deposit, but are usually found near the foot of the cordilleras, and may have come down the side valleys. Indian graves (*guacas*) have been found, dug from the lower bed of soil downwards, and these have yielded gold ornaments of fine workmanship, very superior to those made by the Indians that the Spaniards found here.

The site of this lake offers a great field of study to the geologist, ethnologist, and physicist. The first may speculate on an interglacial age, the second may dig up the record of a prehistoric and preglacial race, whilst the third may ponder over those bamboo lignites, and conjure up eccentricities and precessions and other cosmical notions to account for bamboos that grew on an ice deposit, and were covered by glacial silt. It seems strange that such a field exists within thirty days' easy travel from London, and that no one has visited it.

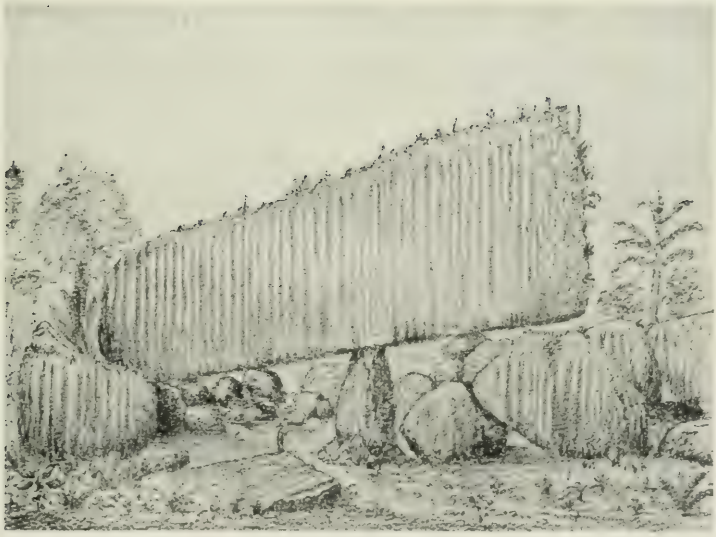
Most of the tributary valleys of the Cauca (that of Buga especially) have their glacier formations as evident as that shown in Sketch No. 3. The glacial character of this lake cannot therefore be doubted.

5. Terraces of Till, etc.

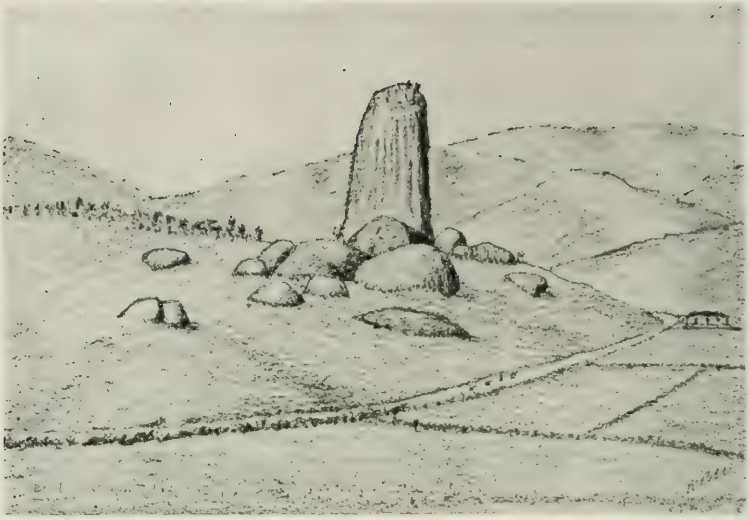
As these form a great feature throughout the country, I notice them especially. Sketch No. 5 shows their general character. It is a view of the ascent from the Magdalena valley to the tableland of Bogotá, passing through Anapoima in the foreground, and higher up through La Mesa. To the right is the valley of the river Bogotá, and to the left that of the Apulo. On the sides of these valleys may be seen two series of terraced *mesas*, corresponding in level with those of Anapoima and La Mesa. These terraced *mesas* are formed of heavy conglomerate with a cap of till. They often carry large erratics on their surfaces. The conglomerate is formed of sand, small and large, more or less angular, stones and rocks of several cubic yards in bulk. All the *mesas* in the country have the same formation.

There are two well-defined series. One occurs at 2900 to 3100 feet elevation, and the other at 4000 to 4200 feet. Of these there are scores. Cases occur in which a similar *mesa* is found at a different height, but at the junction of two valleys with a narrow cañon lower down. It would seem that such terraces were formed where the ice

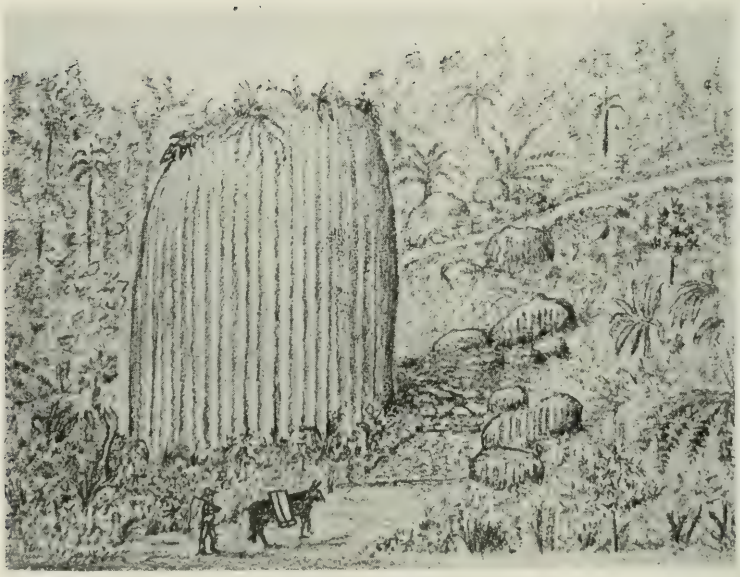
5.—Glacial terraces and mesas, road from Magdalena valley and Bogotá *viâ* Anapoima and La Mesa.



6.—Erratic, 120 feet long, 50 feet high, 70 feet broad, Remedios district.



7.—Erratics and monolith, 214 feet high, near Entrerios on Santarosa tableland.



8.—Erratic, Remedios district.

rested. Hence the two series may mark two periods of repose. The *mesas* of La Mesa and of Ibagué (Sketch No. 2) front each other, sixty miles apart, on the opposite sides of the Magdalena valley, and they have precisely the same elevation above sea-level.

6. Lowland Secondary Glacial Deposits.

These present great problems, which I cannot attempt to solve. I must confine myself to a statement of facts.

If you start at the Ecuador frontier on the Pacific coast, and run a contour line all round Colombia at the 1000 feet level, you will have more or less the upper level of the lowland deposits. This contour line will take you up the river valleys, and into the basins of the rivers San Juan, Atrato, Sinú, Magdalena, Cauca, etc. Everywhere, with but few blanks, one great semi-alluvial deposit characterises this zone. It rests at times on old rocks, where these have been denuded, but over vast areas it lies on the most recent Tertiary strata. In some places a similar formation occurs at higher levels, but local causes account for these cases. They are, however, of importance as showing that the agents which operated in the accumulation of these deposits did not act only on the coast-line, or at low levels. But in treating of so vast a subject, I have to generalise.

Nearly everywhere cemented beds of conglomerate form the base of the series. The stones and rocks are mostly rounded, but many are angular. They vary in size from small gravel to diameters of six and twelve inches (the most common), but boulders of one and two tons in weight are not rare. Following upwards we find layers of clay, sand, gravels well worn or subangular, and in some places one or more beds of cement. All these beds are irregularly stratified. They frequently merge into pure till, formed of clayey red earth with angular stones, and large beds of boulder clay, exactly like that described on page 7 of *The Great Ice Age*. Patches of lignites are met with, made up of known plants and trees, and I have seen very fair jet in such beds. All these different strata may merge one into another, and where you find a true alluvial gravel, you may see it thin out and give place to a till or boulder clay. Sometimes the beds of conglomerate attain a thickness of 200 and 300 feet, and exclude all the other strata. Generally speaking, the rocks and stones seem to have come from the nearest mountains, but sometimes it is hard to say whence they have been derived.

The ordinary thickness of these deposits is from 200 to 400 feet. Denudation has removed large portions.

Gold is found almost everywhere, and what is remarkable is the fact that it occurs as well in the upper as in the lower beds and conglomerates. In gravels formed under water gold will find its way to the bottom in the most surprising manner. It is strange therefore to find gold in a soft top gravel, overlying, perhaps, a bed of sand. I have prospected gold right up a bank 100 feet high, as far as the cap layer of vegetable soil. This gold all shows signs of travel.

That these deposits are formed of ice-borne material there can be no doubt. How it was distributed and arranged is the question.

7. Special Phenomena.

Most of the large erratics are found on high lands, generally marking the watershed of two basins, where probably the glaciers rested and finally melted. All over the Santarosa plateau immense piles of erratics are found, like that shown in Sketch No. 7, except for the great monolith. This I triangulated, and found to be 214 feet high. In some of the small valleys and ravines these piles of rock defy description. The little valley where the block shown in Sketch No. 6 occurs is piled with hundreds of such stones. Close to the one shown is a half-buried block, which measures 140 feet long and 72 feet high.

The rock shown in Sketch No. 8 is one of thousands scattered about on a plateau divide.

The vertical furrows on these stones are very wonderful. The material is syenitic granite. The furrows are 2 to $3\frac{1}{2}$ feet deep, and the ridges left between them are so thin that large slabs may be broken off them. At the back of the stone shown in Sketch No. 8 some steps in the mule trail are made of such slabs.

Where one stone in a group is furrowed most of the others are also, and, saving where a stone has moved from its original position, the furrows are all vertical. The granite is very hard and quite homogeneous.

Nos. 6 and 8 are both in the Remedios district in Antioquia, but lie some thirty miles apart.

I should have mentioned that the block in Sketch No. 6 is 120 feet long, 50 feet high, and 70 feet wide. It weighs, therefore, over 32,000 tons. The monolith upon which its centre rests has been crushed by the weight, and the shattered slivers are heaped around its base.

May such rocks have bored shafts in the ice, and when once at the bottom have been exposed to the action of cataracts of water, mud, and stones pouring down the shafts? I have seen rocks lying in pools of water on ice, but how far they could bore down, or how long they could preserve their head, I do not know.

The löss of this country deserves a special study. It is found on glacier plains, on mountain sides, and on hill tops, and it is always the same löss—a tough, unctuous clay. On the lower glacier fields the löss contains double hexagonal pyramids of quartz, from $\frac{1}{16}$th to $\frac{1}{4}$ inch in diameter. These crystals are not worn. After rain they may be seen glittering in the sun by thousands. I have gathered them all over the country, and they certainly originated in the glacial detritus.[1]

8. Fossils, etc.

I have tried to find fossils in the marly beds, the lacustrine deposits etc., but have not met with any. The mastodon remains are found in

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[1] In a memoir on the mines of Huancavelica in Peru, by a French engineer, published in *Les Annales des Mines* some time in the forties or early in the fifties, the glacial deposits of the Peruvian Andes are well described, although the writer did not know what they were. He also speaks of the little brilliant double pyramids of quartz. This memoir is of great interest.

the upper beds, and must be very modern, as the ivory of the tusks is often well preserved. The carbonised vegetable remains are those of existing plants.

Man clearly inhabited the country in some sort of interglacial age. There is good reason to believe that he and the mastodon were contemporaries.

9. Age, etc.

The Glacial epoch in Colombia was Pleistocene. There is no evidence to show that any change in the relative level of sea and land took place either during or after the ice period. All the general features of the country appear to be unchanged since the ice time. The vegetation is more or less the same. True it is that many plants—bamboos, for instance—could subsist in a temperature 5° C. lower than the present. Now, with the temperature 5° lower, the whole three cordilleras of the Andes would be covered with perpetual snow, and the glaciers could find their way down to the warmer levels. If the atmosphere had been so much less dense as a pressure of three inches of mercury would correspond to, the snow-line would have been from 4000 to 5000 feet lower. At various periods in the world's history the atmosphere seems to have been at times rich and at others poor in carbonic acid gas, and, naturally, with a less dense atmosphere there would be a lower temperature.

To return to facts. The volcanoes of the Andes were all vigorously active during the Ice Age. Dozens of extinct volcanoes, now almost unknown, were pouring out lava and raining ashes and pumicestone down upon the glaciers. Thus the deposits of the lower and upper Magdalena and the Pasto region were originated. One has to see these deposits to realise what they are. No such phenomena are, to my knowledge, presented in any other part of the world.

Mr. White's notes on a region so little known are very welcome. Some doubt naturally attaches to the recognition of glacial phenomena in a country where rock-weathering is so active. The great depths attained by the rotted granitoid rocks of Brazil, and the abundant distribution over wide tracts of isolated blocks, boulders, and rocking-stones (the remnants of more or less disintegrated and irregularly degraded rock-masses), suggest doubts as to whether all the "till" and "erratics" described by Mr. White are really of glacial origin. The "erratics" shown in figures 6, 7, and 8 have a suspicious resemblance to the relics of disintegrated granitoid masses. We hope the author may be induced in a future communication to enter into more detail with the view of showing what is the particular evidence which has led him to the conclusion that these are true erratics, and that the "plateau-till," for example, is not the result of weathering of rocks *in situ*, but the product of glacial action. Mr. White has been so long resident in Colombia that, with his knowledge of the glacial phenomena of Europe, he should be able to give us a very interesting account of the particular glacial phenomena he has observed in South America. His "brief notes" whet the reader's appetite for more.—Edit.

NOTES FROM THE EQUATORIAL PROVINCE.

By A. D. Milne, M.B., C.M.

On the journey from Wadelai to Bedden island one cannot help being greatly struck with the effects of the slave-trade, more noticeable, perhaps, between Dufile and the last-named place. Many persons talk glibly about slavery without realising a tenth part of what it means. Here, as one marches through the country, the truth is day by day silently but forcibly impressed on the mind.

From Wadelai to Dufile the road lies through the country of the Shuli and Madi, and Wadelai itself is also in their domain, though a strip of land is occupied by the Aluro—all these are great agriculturists. At the former place the chief object of interest to the newcomer is the old *zariba* of Emin Pasha, known to our older soldiers and the natives as Emin Bey. It stands some two miles farther down the river on the opposite, western, bank. We made a trip to it in company with an Effendi or Nubian officer, who had been a sergeant in Emin's force. A landing was effected on the shelving bank where the steamers used to be moored beneath the shadow of the earthworks, of which traces are still discernible. On mounting the bank we came to the zariba, but to our disappointment there was little to see.

As most of Emin's forts are on the same plan one general description will suffice for the stations Dufile, Regiaf, and Lado. There still remains the 8-foot-deep ditch on three sides with its protecting earthworks, now much flattened down by the annual rains. The fourth side, of course, faced the river. Inside the fort was a tangle of tall grass and undergrowth. The gateway, with its narrow earthen gangway across the ditch, faced inland. At the south-western corner was a broad earth bastion, "where the big gun stood." Near the river was the site of the stores and magazine houses, and I picked up here a piece of charred tusk, a confirmation of the Effendi's story that the store had been accidentally burned and a valuable hoard of ivory destroyed. Of buildings or visible foundations there was none, and there was no guide to their situation but the Effendi's words as he went round pointing out here the "big house," *i.e.* the Pasha's, here a magazine, there the soldiers' quarters, and there—a reminiscence of personal interest—his own hut. Struggling through the elephant grass and undergrowth we kicked against flour grinding-stones and sherds of black clay water jars, left behind when the station was abandoned. These, and some tall flourishing laburnum-like trees, from which the Pasha taught his soldiers to extract oil, were the only slight tokens of former occupation.

From Wadelai my route lay inland through the Madi country—water transport not being available at the time—probably along that of Chippendall (1875), Gordon's lieutenant. As it was towards the end of the rainy season, in October, marching was not pleasant through 12-foot grass, over sodden ground, and across flooded rivers. The villages, which I could not identify with any marked on existing maps, were often very prettily situated, nestling among gigantic boulders on the top of small

knolls, with one umbrageous tree spared by the axe, under which the villagers—generally the men—lounge in the shade and while away the hours. The Madi and Shuli are keen agriculturists, and the land generally gives the impression of being well cultivated. The natives are well fed, and prosperous. Most of the bigger chiefs own cattle: one herd I counted contained eighty head. It is not difficult to be in easy circumstances with no need of clothes and soil capable of bearing three crops a year.

At Dufile we crossed the Nile, here, above the rapids, very broad and sluggish. There used to be a road to Gondokoro on the east bank, but as the country on that side is uninhabited, and no native seemed able to point out the track, we used, by the courtesy of the Belgian officials, the road through the territory of the Congo Free State. While we were at Dufile an interesting incident occurred—the finding of the site of Afuddo, which Baker spoke of as the point destined to become the capital of Central Africa. We were looking for a place for a permanent station on the east bank of the Nile, near the river Unyama, and were keen on locating this desirable spot. But all inquiries were met with the usual *Anarafu mafie* (I do not know). Coming back one day to the camp on the banks of the Unyama, one of the permanent rivers running into the Nile opposite Dufile, we lighted on the site of a deserted village on a slightly elevated bit of ground close to the river's bank, with rather more than the usual native attempt at a ditch and earthwork. This our guiding chief casually informed us was Afuddo (Baker states that the name was applied to the district). It is situated on the east bank of the Unyama, about four miles from its mouth. We now found that our pronunciation was at fault, and hence the repeated *Anarafu mafie*: we had always said *Affūdu* instead of Afuddo. About 400 yards below on the opposite bank the site of Baker's camp was pointed out to us, and a mile or so away stood the flourishing villages of his day. Near Afuddo we were shown where the last slave-raider's camp was pitched. It was lamentable to see the country in its present state—a veritable desert, with undergrowth, shrubs, and tall grass everywhere, where once waved the heavy-headed sorghum and the smaller rush-like *telebun*, and sweet potatoes crept along the ground. Evidence of former cultivation were the open spaces and the absence of all trees for some distance around. The more marked this is, the larger must have been the village. With the natives the presence of the *Muzungu*, or white man, is indicated with certainty by the remains of his latrine holes. When these were pointed out in Baker's camp, the proof was quite conclusive.

The road from Dufile onwards is one long monotonous exposition of the terrible results of the slave-trade. Deserted sites begin to appear on the second day out, marked by stones resembling in miniature Druidical remains, which formed the lower parts of the huts. It is no exaggeration to say that in some places we almost stepped from one graveyard to another of these stones. The road, climbing over a ridge of hills, dropped down to the river's bank along one of the prettiest walks I have seen in Africa. The broad river running swiftly below, tumbling and swirling over its 70 miles of rapids with a pleasant subdued roar, gave

one that happy consciousness of abundant water near at hand which is always delightful in Africa. Giant hills rose from its edge, clothed with trees to the very summit; schools of hippos, grunting peacefully, basked in the quiet pools below the stretches of troubled water; and over all the sun's radiance, rather warmer than was exactly agreeable, lighted up a view that is indelibly impressed on my memory.

Labore, perched on the top of a small hill, with its stone walls thrown up by Gordon under fire in two days, and facing up and down the river, also affords a view that never palls. But here the river is less confined, and on either side ranges of hills and distant mountain peaks may be discerned inland. The fort was in a fair state of preservation, though the walls had given way in some places. This also was an immense zariba. It was hard to realise that in those old days—what a glamour hangs around them!—grapes, pomegranates, and limes grew here; now only a few bird-peppers could be discovered straggling outside the walls, indigenous to the country and too hardy to be snuffed out by the fires. Under a big tree at the topmost part of the knoll, a few feet away from what was pointed out as the foundations of Gordon's house, I picked up a bit of red-coloured china that had escaped the sharp eyes of the natives all these years; and it pleased my fancy to imagine that this was, perhaps, all that remained of Gordon's teacup, and that it was his custom too, as of the present occupiers of the fort, to take tea under the shade of this tree after the burden and heat of the day.

All along the road to Bedden the country is inhabited by Kuku—or what remains of them. They have now all retreated towards the mountains, two days' march inland, out of the way of the Dervishes. Signs of human habitation on the riverain strip are few and far between.

At Bedden the Bari country is entered. Prepared by Baker to find a land literally overflowing with cattle and cultivation, we found the reality exceedingly startling; everywhere the same stone circlets, some with trees of 30 feet growing in them, everywhere the same clean sweep. Climbing a knoll, we saw the never-ending waste of dried-up forest land running north away to the blue Lado hills, the bends and reaches of the Nile show up here and there amid the appalling flatness like puddles of stagnant water, dimly reflecting the sun's rays, and joined in a sinuous line by a vivid green fringe of papyrus and reeds, until lost in the haze of the horizon. There are, indeed, a few inhabitants, but they drag out a miserable existence on the numerous islands in the river, with but few goats and no cattle. Inland, two or more days' march distant, they are met with again, away from the accursed river and its boatloads of Dervishes. When the islands can no longer support their inhabitants, small patches of sorghum are grown on the mainland; and it is a novel sight to see the natives floating across on light rafts of ambatch, which look so cumbrous out of the water. The Bari are a cattle-grazing tribe —with no cattle. There is certainly no aggressiveness about them now. They strike one much as the Masai do farther south, with the cattle-plague robbing them of their only means of support. Broken down and harried by the Dervishes ever since Baker's time down to the year 1897, when these scourges of humanity were expelled from Regiaf by the

Belgians under Commandant Chaltin, and vanished from the country, let us hope, for ever, the Bari, with all their cattle carried off by the plague, seem to be a dying race.

Bedden island proved to be in possession of five or six fruitful lime-trees. Everything on the mainland is burned up by the annual fires. Of other signs of former occupation by white men there is a small rampart, about 40 feet long, at a corner where the garden used to be; probably it was raised for irrigation purposes. Every other structure has been razed to the ground by the rains and the natives. About six miles below Bedden we crossed the river and established Britain's latest station, the farthest north from Uganda—Fort Berkeley.

GEOGRAPHICAL NOTES.

By The Acting Editor.

EUROPE.

The Lago del Matese.—Dr. G. de Agostini, whose limnological work has already been referred to in these pages, has examined the Lago del Matese in the province of Caserta. It is at a height of 3304 feet on the southern slope of the Monte Miletto (6725 feet high), the most elevated of the Matese group. Its area varies with the seasons, its length being in summer about 2½ miles and average breadth 610 yards, when it covers about 740 acres; at the end of winter it is fully 3 miles long. Several springs feed the lake with water at a temperature of 44½° to 45½° F., of which some is carried off by evaporation, some by percolation, while the remainder escapes by a funnel at the east-south-east corner of the lake. The basin is excavated in semi-crystalline limestone of the Cretaceous system. The temperature of the water on July 27th was 72½° F. on the surface, and 71½° at a depth of 6½ feet, the temperature of the air being 72½°. This hollow, surrounded on all sides by lofty mountains, is remarkable for the humidity of the air. The lake contains excellent tench, which are caught by the neighbouring fishermen from dug-out canoes of beechwood. Flocks and herds are fed in the neighbourhood during the summer, rye, fodder, and potatoes are harvested, and the woods furnish material for an active charcoal industry.

Dr. de Agostini has also worked out the relief of the basins of Como, Mezzola, Garlate, and Olginate. Out of some 5000 soundings in Lake Como the deepest was 1345 feet, about half a mile south of the Punta della Cavagnola. Como is, then, the deepest of Italian lakes (Lago Maggiore, 1220 feet; Garda, 1135), and is only surpassed in Europe by the Hornisdalsvand (1595), and the Mjösen (1483). The bottom temperature of the Como lake is 42·8° F. The Lago di Mezzola, north of Lake Como, has a maximum depth of 226 feet, and a bottom temperature of 43·3°. The maximum depth of Garlate, south of Lecco, is 112 feet, and the bottom temperature 47·7°. The maximum depth of Olginate is 57 feet, and bottom temperature 48°.—*Boll. della Soc. Geogr. Italiana*, Nos. 3 and 6, 1899.

ASIA.

Mt. Kinabalu.—The height of this mountain was measured by Captain Belcher, who gave it as 13,698 feet above sea-level. Mr. H. T. Burls, who has recently ascended it for the purpose of geological investigations, reached a point where the

boiling-point thermometer read 191·9° at an air temperature of 49°, giving a height of 11,643. As the summit, according to his estimate, was only 400 feet higher, the total height would be 12,043 feet. The upper 1200 feet is a surface of bare rock, on which it is impossible to walk in boots, and therefore Mr. Burls, not being provided with any substitutes, was obliged to turn back after accomplishing two-thirds of the distance. Bad weather was experienced all the time of the ascent. The summit was enveloped in dense mist after 11 A.M., and before that hour mist lay over the surrounding country. Rain fell every afternoon. The natives at Kiau said that it rains every afternoon throughout the year, but the season was exceptionally wet; on one occasion 2·06 inches of rain were collected in two and a half hours. The lowest temperature, 44°, was recorded in the night of April 13th at a height of 10,360 feet. The central core of the mountain, formed of syenite, seems from a distance to be table-topped. Mr. Burls did not find any metamorphic rock; at 8800 feet there is a direct transition from limestone to syenite, and under the limestone lies a shale, followed by sandstone at 7175 feet. The central peak is very ancient, and probably rose as an island above the Devonian or Carboniferous sea in which the limestone was laid down; probably the latter took the form of a fringing reef.—*Geographical Journal*, August.

The Geology of the Kapuas Basin.—Since Dr. Posewitz wrote his book on Borneo in 1889, so much more definite information has been obtained of the Dutch part of the island that a geological map compiled now would be very different from that of this author. Especially is this true of the Western Department, and of late years the Kapuas region has been so far examined that a general sketch can be given of its geology. The occurrence of a chalk formation, probably Cenomanian, on the Seberoeang river was known many years ago, *Orbitolina concava* having been found in it; and the same fossils were found in 1880 on the Bojan river in Boenoet by Van Schelle, who, however, stated that by far the largest part of the valley was covered with Tertiary deposits. Everwijn discovered fossils on the Melawi river close to its confluence with the Kapuas, which were identified by P. van Dijk as Tertiary. Until 1896 these were the only positive data on the age of the deposits in the Kapuas basin.

A shale found by Van Schelle near Sepang (Sambas) was supposed by Martin to be of Mesozoic age, but afterwards impressions of ammonites were found in it by Heer N. Wing Easton, and these were affirmed by Krause to belong to *Harpoceras radians*, Rein., so that the strata are of the Lias group. And not only is the lowest group of the Jura system present, but fossils from Boedoek, Bengkajang, Kendai, and Tengoewe prove that the strata containing them are Upper Jurassic. The engineer, M. Koperberg, collected from a limestone bank near Temojoh, on the middle course of the Landak, a number of fossils which have not yet been thoroughly examined, but are at any rate Cretaceous. Heer Easton believes them to belong to the Gault or Cenomanian series.

On the S. Selangkai, a tributary on the right bank of the upper Silat, Heer Easton found two different layers of *Orbitolina* marl, the strata dipping 40° to 45° towards the south. Immediately below the lower bed was a very coarse breccia, consisting principally of granite. Evidently this is a coast formation. On the Seberoeang the breccia was absent, and the whole surroundings of the *Orbitolina* marl were different, so that there probably a third fossil horizon is present. Both on the Seberoeang and Selangkai the dip is rather steep to the south, while on the Bojan the strata dip steeply to the north. The next younger formation, lying conformably above the other, occurs in the middle course of the Silat, in a deep series of thin sandstones with argillaceous sheets between. Beneath is a thick

bank of breccia-like sandstone, containing minute fragments of quartz, felspar, and a fine-grained eruptive rock. This sandstone is widely spread in Sambas. In the west this formation dates from the Cretaceous period, while in the east its age is doubtful. Macroscopic fossils have never been found in it. The same uncertainty at present exists about the age of the next series, consisting of hard, dark clay-shales much broken, with sandstone and gray marl below. Most remarkable is a thick bed of shale, 50 to 65 feet thick, full of gasteropods and other fossils. The question is whether these beds belong to the Upper Chalk or Lower Tertiary.

From the neighbourhood of the source of the S. Dait stretches in nearly a southern direction over the eastern boundary of Landak a granite range, interrupted by recent volcanic rocks, which crosses the Kapuas and then spreads eastward in a broad mass over the districts of Meliau, Sempang, Sekadau, and Matan; granite also is the prevailing rock on the north-eastern boundary of the Department. The deposits of the Kapuas basin proper extend southwards and westwards to the granitic region. The Cretaceous deposits form a long extended zone from about the upper course of the S. Boengan in a west-south-westerly direction to the upper part of the Boenoet district, where it turns westwards through the basins of the Embau, Seberoeang, and Silat, and then runs west by north to the Merdai mountain. In Landak and Sambas this formation seems to run west-north-west and north-west.

North of the source of the Dait to the Sarawak frontier, granite is totally absent, and it may be concluded that in Cretaceous times the Kapuas basin was drained in this direction, and that the breach at Tajan was formed much later. The Cretaceous ridge divided the Kapuas basin into two unequal parts. The northern smaller part contains a number of large shallow lakes; probably owing to the upheaval of the ridge it was badly drained, and even now the river from Poetoes Sibau to Semitau meanders through swampy flats. The southern part is drained by the Melawi, and contains no morasses of any importance.

Tertiary formations containing seams of coal lean up against the Cretaceous ridge, both on the north and south. On the Melawi, above Nangah Pinoh, the beds seem to be of somewhat later date, and not improbably Cretaceous rocks may be found again up the left tributaries of the river, though they may be completely covered by Tertiary deposits. Outside the Kapuas basin proper, no formation has yet been discovered corresponding to the Melawi system, and, on the other hand, the Jura formation does not occur in the Kapuas valley, unless it underlies the Cretaceous. Both Martin and Krause regard the Melawi system as of brackish water origin. The Kapuas basin received large quantities of salt water from the north, east, and south, and both the Cretaceous and Tertiary strata show evidence of having been laid down in shallow water. The thickness of the beds is accounted for by a slow subsidence from the beginning of the Cretaceous period. Then succeeded more violent movements—first a very rapid sinking, which destroyed all living organisms and folded the strata, and then eruptions of andesites on an enormous scale. But the subsidence stopped sooner on the north than the south, where alone a considerable depth was reached; and part of the gasteropod slates were tilted over. In the deep basin sandstone was laid down in thick beds, interspersed in favourable spots with conglomerates, and these now reach an absolute height of nearly 5000 feet. They contain no fossils, but may be assigned to the Miocene or Pliocene age.

Afterwards a slow upheaval began, and after some parts became dry land, the water sought an outlet at Tajan. Owing to erosion the sandstone now forms more or less extensive plateaus on the upper courses of the rivers or long low ridges

between them, while in the plain a few gigantic remains are left, such as the G. Kelam 3300 feet high, a little east of Sintang. After the andesite eruption volcanic energy seems to have become extinct in the Kapuas basin. In Sambas and Landak outflows of basalt took place in much later times, spreading out in long streams and sheets. The slow upheaval just mentioned seems to be still proceeding, and not only in the Kapuas basin, but also along the coast.—*Tijdschrift van het Kon. Nederl. Aardrijkskundig Genootschap*, Deel xvi. No. 3.

AMERICA.

Geographic Board of Canada.—At the end of 1897 a Board was appointed, consisting of members of the various departments of Government, to fix the names of places in the Dominion and the form of spelling. The rules adopted are those in use here and by the United States Board, which were published in the *S.G.M.*, vol. viii. p. 27. This is so far satisfactory, and it is to be hoped that all the British colonies will in time adopt the same regulations. Nevertheless, uniformity is not thereby secured, as we see in the case of Lake Lebarge, so spelled by the United States Board, while the Canada Board in its first *Report* just issued spells it Laberge. We believe that the lake was named after a telegraph employé, Lebarge, but, at any rate, as Lebarge or Laberge is the form always found on maps, it would have been better to choose one of them. In these cases, now that a Board has been formed in Canada as well as in the United States, each Board will no doubt accept the decisions of the other within its own territory.

The Age of Niagara.—The American geologist, Mr. G. F. Wright, has employed a new method of solving this much-discussed question. All attempts to determine the time necessary for the formation of the falls by observing their retrogression must fail because, since the end of the Glacial Period, the quantity of water at Niagara must have varied considerably. For a long time the water of the great lakes flowed into the Ottawa river, and built up a huge delta at the mouth of Mattawa valley. Wright endeavours to ascertain the length of time required for the excavation, by weathering, of the Niagara gorge at its termination near Lewiston on Lake Ontario. At first the gorge could not have been much broader than the river, that is, about 770 feet, and since then only atmospheric forces, of constant strength, have been at work on it. At the present day the uppermost limestone strata are 388 feet, measured horizontally, from the bank of the river. By careful measurements Wright has ascertained that a layer, at least a quarter of an inch thick, is annually removed from the slope on which runs the railway, built in 1854. This is the minimum, and the mean is probably much greater. But even at this rate the gorge would have been expanded to its present breadth in less than 10,000 years.—*Globus*, Bd. lxxvi. No. 5, from *Appleton's Science Monthly*.

The Physiography of the Nicaragua Canal Route.— Mr. C. Willard Hayes, of the U.S. Geological Survey, who was sent out to Nicaragua in connection with the Canal Commission, has contributed a paper with the above title to the *National Geographic Magazine* for June. The region is sharply limited on the south by the high volcanic range of Costa Rica, which stretches diagonally across the isthmus, while on the north it is less distinctly defined by the increasing height of a plateau which merges into the mountains of northern Nicaragua. Between lies a broad irregular depression drained chiefly to the Atlantic, for the watershed lies within a short distance of the Pacific. This depression is not a simple valley, for the portion between Lake Nicaragua and the Caribbean Sea embraces two distinct drainage basins, the streams of which formerly flowed in opposite directions.

The topographical features group themselves naturally into three classes. Extending northwards from the Costa Rican volcanoes to the San Juan river and beyond, are many hills of nearly the same height in a direction from south to north, but rising higher and higher from the coasts to the axis of the isthmus. Near the San Juan they are steep and have rounded summits and steep slopes, but some distance back the intervening valleys become narrower, and areas of level or undulating land occur at about the height of the hills. Evidently these hills and plateaus are the remains of a plain gradually sloping up to the axis of the isthmus. If this plain were reconstructed by the filling up of the valleys, it would stand at an altitude of between 100 and 200 feet. Some eminences rise distinctly above this old plain level, residual hills which, being composed of harder rocks, were never reduced to the level of the plain. These, were the plain reconstructed, would separate its eastern and western portions in an irregular line, the low gaps between them being slightly above the level of the plain. The greater part of the erosion was accomplished when the land was somewhat higher than at present, and the valleys much deeper. The recent change has brought the lower portions of the valleys below sea-level, and the rivers have silted up the estuaries thus formed, producing the alluvial plains through which they now meander. During most of the time these geographical features were being developed, the Pacific coast had an outline very different from the present. The site of the lakes Nicaragua and Managua was in part the basin of streams flowing to the Pacific, in part open ocean, and in part a bay with its southern point near the present island of Madera. Lake Nicaragua has an area of very nearly 3000 square miles, and its surface is about 104 feet above the sea. The most interesting feature in its bed is an old channel, which marked the course of a river formed by the union of the streams now entering the lower end of the lake with the one which occupied the upper part of the San Juan valley. Slightly indicated near the Solentiname islands, it is continuous and distinct from ten miles to the north-west up to Madera. The greatest depth in the lake, over 200 feet, occurs in its western part.

To the west of the bay which formerly ran from the Pacific to Madera island was a long peninsula, which now forms the watershed between the lake and the Pacific. It is particularly interesting, because it contains the lowest gap in the continental watershed between the Straits of Magellan and the Arctic Ocean. The plain on the south-west side of the lake, called by Mr. Hayes the Rivas plain, probably formed a part of that which occupied the Nicaraguan depression, and the Tola hills correspond to the residual hills of the depression. They have a serrated crest, with summits varying between 800 and 1800 feet in height. At one time the continental divide lay farther west than at present, and a stream occupying the position of the lower Rio Grande, having a short steep fall, cut its way backwards and captured the eastward-flowing stream which occupied the present valleys of the Tola, upper Rio Grande, Guiscoyol, and the lower Las Lajas, finally pushing back the divide to its present position at Espinal. The deserted river valley, from which the beheaded Guiscoyol now flows to the lake, forms the lowest gap in the continental watershed. Its summit is only 154 feet above sea-level, and during the wet season is occupied by a swamp which apparently is drained both to the Atlantic and Pacific.

The mouth of the old bay has been filled up by volcanic accumulations. A line of volcanoes, all geologically quite recent and some still active, extends from the twin peaks of Madera and Omotepe to Coseguina on the Gulf of Fonseca. The summit of the last was blown off in 1843 by an eruption only less violent than that of Krakatau. These volcanoes rise from a plain composed wholly of

volcanic materials. To the south-west of this plain, separated by a rather steep escarpment, is a plateau rising gradually to an altitude of 1200 feet towards the Pacific coast. It is composed of exactly the same material as the plain, and was probably continuous with it, but has been separated from it by a fault.

Probably in early Tertiary times the waters of the Pacific and Atlantic had free intercommunication across this part of the isthmus, and then sedimentary rocks accumulated and volcanic rocks were poured over them. In middle Tertiary times this region was elevated above sea-level, and a long period of erosion succeeded, the main divide being near the axis of the isthmus. Then there occurred an elevation of the country, and the rivers began to trench the surface of the base-levelled valleys. Shortly after there was a renewal of volcanic activity, and this period of eruption has continued to the present time. It has built up the Costa Rican and the Nicaraguan volcanic ranges, the latter damming up the water till it rose to a gap in the continental watershed and began to flow eastward. The latest episode in the geological history of the country was a depression to the extent probably of 100 or 200 feet, which submerged the lower portions of the river valleys. The streams flowing to the Pacific have in most cases filled them up with sediment, forming alluvial plains.

The San Juan river may be divided into three sections, the first extending from the lake to the Toro rapids; the second from the Toro rapids to the San Carlos river; and the third from the mouth of the San Carlos to the sea. The first section probably once formed part of the lake and was silted up by the streams which entered it, many of which have become tributaries of the San Juan. From the rapids to the San Carlos the river has a considerable fall and flows through a narrow valley. The Toro rapids, which retain the lake at its present level, are formed by boulders, sand, and clay, no doubt a delta thrown by the river Sabalos across the lake when it extended thus far. Quiet reaches separated by rapids extend thence to Machuca, the fall being about 40 feet or an average of 2 feet per mile. Between Machuca and the San Carlos the river evidently occupies a bed which was cut when the river was higher than now, and which has not yet been filled with sediment. The bottom of the channel is in some places below sea-level.

Above the San Carlos the San Juan is a clear stream with a moderate current, except at the rapids. Below, it is usually muddy and has a strong current, the slope being nearly a foot to the mile. The San Carlos, as well as the Sarapiqui, rise on the slopes of the Costa Rican mountains and are loaded with volcanic sand, and have rapidly built up the flood plain, so that the San Juan skirts its northern edge. The smaller tributaries of the river have built up their flood plains less rapidly and many lagoons have been thus formed.

Dr. Paul Krüger on the Rio Yelcho.—In April Dr. Krüger returned from an expedition which lasted six months. He began his exploration by ascending the Rio Yelcho in a cutter and rowing boats as far as it was navigable. He then followed it on foot through the forest, and higher up was able to use flat-bottomed boats. The result of his exploration was to prove that the Futaleufu (or Staleufu) is not the Rio Frio, a tributary of the Palena, but the upper course of the Yelcho. At its mouth the Yelcho forms an extensive delta consisting of a dozen smaller or larger arms which enter the sea to the north and south of, or opposite to, the hilly and wooded island Puduhuapi; the main channel is the southernmost. For about 30 miles the river runs from the south-east, with deep clear green water, and is 300 yards broad above the delta. The valley is comparatively narrow, in some places only a mile and a quarter across, and on both sides of the river the ground is level

enough for a road. At one point the river expands into a lake about 15 miles long by 2½ to 3 broad, lying at a height of 210 feet above sea-level, which was named Lago Yelcho or Futalafquen. To the south, in the neighbourhood of the sources of the Corcovado, lie six glaciers.

The river is still navigable for 9 miles above the lake, the whole distance traversed in boats being 55 miles. The tributaries are comparatively insignificant. At 43° 27′ S. lat. the river makes a sudden bend to the north-east, and in this direction a troublesome march of 36 miles occupied thirty-eight days. The river falls in this distance nearly 660 feet and flows through a succession of narrows, forming at one point a cascade 40 feet high and only 9 yards broad. Between the narrows it expands to over 100 yards, and here are wooded plains suitable for pasture. In the latter part of the march the *Libocedrus Chilensis* was the tree most frequently noticed.

At 43° 11′ S. lat. the river bends to the east, becomes quieter and expands to a considerable breadth, enclosing a series of islands. In this section the river was navigated to the mouth of the Rio Corintos in the Valle 16 de Octubre, and then the main object of the expedition was accomplished. Dr. Krüger, however, followed the valley up to Lago Situacion and thence to Lago Menendez, thus connecting his route with that of the Reñihue expedition which he led two years ago (see vol. xiii. p. 377). About 4 miles above the Rio Corintos navigation ceased to be possible, and north of Lago Situacion the river forms a nearly continuous series of rapids and narrows. Six large and twelve small lakes were discovered by the expedition in the basin of the Yelcho or Futaleufu, in addition to those already known. This river is one of the largest of Patagonian streams, only surpassed by the Rio Aisen below its confluence with the Rio Mañiuales (and, perhaps, the Rio Baker or Las Heras). Not one has at the distance of 110 miles from its mouth such a volume of water as the Futaleufu in the Valle 16 de Octubre.

On the coast a few further investigations were made. The Rio Chaiten, entering the sea to the north of the Yelcho, was found to be of no importance. The Palbitad fiord, marked on charts to the south, does not exist, but only a small stream about as large as the Chaiten which Dr. Krüger named the Rio Palbitad. The bay at the southern end of Puduhuapi affords safe anchorage for vessels of all draughts.—*Verhandlungen der Gesell. für Erdkunde zu Berlin*, Bd. xxvi. Nos. 5 and 6.

In the *Geographical Journal* for August Dr. F. P. Moreno, the Argentine explorer, claims priority in the discovery of the rivers entering the Baker Channel which have been visited lately by Dr. Steffen (see pp. 322 and 432). The Calen inlet, Dr. Steffen's Baker Channel, appeared in the map of Padre Josef Garcia, who visited its entrance in 1766, and Dr. Moreno, with the Argentine steamers *Azopardo* and *Golondrina*, explored it in 1897, when the name Las Heras was given to the Rio Baker of Dr. Steffen, and the river Colihue (Rio Bravo) was partly explored, as well as the Rio Toro (Rio de la Pascua), which is the outlet of the San Martin lake, while the Mayer flows into it. Two islands, which were named Azopardo and Hercules, divide the inlet into two parts, while another farther south was called Golondrina. The Las Heras river flows from Lake Soler, which receives the waters of Lake Buenos Aires. These names are marked on a map handed by Dr. Moreno to the Royal Geographical Society in February last.

OCEANS.

Deep-Sea Temperatures in the Indian Ocean.—The latest number of the *Zeitschrift der Gesell. für Erdkunde zu Berlin* (No. 2) is wholly taken up by the reports

of the *Valdivia* expedition. Special attention was paid to the temperature in the Indian Ocean, as the records are very scanty compared to those that have been obtained in the Atlantic and Pacific. Dr. Gerhard Schott states that, though Antarctic water is of course to be found in the depths of the Indian Ocean, a constant flow towards the Equator cannot be demonstrated with such certainty as in the South Atlantic. Traces of a regular under-current, however, though few and indistinct, are still perceptible. The isothermobath for 10° C. rises both from the north and south towards the Equator, and the isothermobaths of 20° and 15° C. rise only between 12° S. lat. and 8° N. lat.. Such a swelling up of the deep water can only be maintained by a constant afflux of the South Polar water along the floor of the ocean.

The Indian Ocean, as far as the monsoon region and the accompanying semi-annual movements of the water extend, exhibits a very interesting phenomenon in a degree perhaps not to be observed in any other ocean. A *Sprungschicht* occurs at a depth of 27 to 110 fathoms similar to that found in large fresh-water lakes. Down to this depth the temperature differs little from that of the surface water, but here a sudden large fall takes place—often as much as 14° to 16° F. in an interval of 10 to 14 fathoms—and then the slow decrease of temperature begins down to the greatest depths. Evidently insolation proceeds only to the upper level of the *Sprungschicht*, whereas the other temperatures depend on currents and vertical displacements of water. It would seem that, though periodical and locally strong and even violent currents are present, yet on the whole the water within the monsoon region is always the same, wherefore the conditions are similar to those of a lake, and the existence of the *Sprungschicht* is quite comprehensible.

A homothermal layer is situated from about 500 fathoms downwards in the Sumatra Sea between the west coast and the outlying islands. The same bottom temperature, 42·6° F., was always recorded where the depth exceeded 500 fathoms, even down to 700 and 1000 fathoms, where from the conditions in the open ocean 7° or 5° would be expected. Consequently the Sumatra Sea must be shut off from the Indian Ocean at a depth of about 500 fathoms, or the colder water would flow in. The greatest depth sounded in the channels examined by the *Valdivia* was 370 fathoms, while in the Sumatra Sea the maximum was 914 fathoms, and therefore depths of 1100 are not improbable.

Temperature of the Antarctic.—M. H. Arctowski of the Belgian Antarctic Expedition gives an account of the temperature of the air during the voyage of the *Belgica* in *Ciel et Terre*, August 1st. Hourly observations were taken night and day. The coldest month was July, with a mean temperature of – 10·3° F., and a minimum of – 34·8° ; the absolute minimum of the year was – 45·6°, in September. The warmest month was February, with a mean of 30·2° and a minimum of 14·7°. If the months of June, July, and August be considered the winter months, and December, January, and February the summer months, the mean winter temperature was 1·8°, and that of summer 29·3.° The annual mean was 14·7°. In winter, maxima of 30·2° to 32° were recorded, about the equinoxes 32° to 33·8°, and in summer they rose to 35·6°. These figures show that between 70° and 71° S. lat. and 85° to 95° W. long., the mean annual temperature is lower than that of the northern coast of Spitzbergen (Mossel Bay, 16°), and the minima are as low as the minima on the east coast of Greenland. The mean temperature of the three summer months is lower than in the Arctic ocean, for the mean of June, July, and August during the three years' drift of the *Fram* was only 29·8°, whereas on the *Belgica* it was 29·3° in December, January, and February.

MISCELLANEOUS.

The *Diana* has sailed from New York with supplies for Lieut. Peary's party, and Dr. Stein has taken passage in her for Ellesmere Land.

Dr. Lauterbach, the first European to reach the Bismarck range in New Guinea, is setting out again to explore the Ramu river and the Bismarck mountains more thoroughly.—*Verh. der Gesell. fur Erdkunde zu Berlin*, Bd. xxvi. Nos. 5 and 6.

The meeting of German Naturalists and Physicians will be held at Munich from September 17th to the 23rd. Among the geographical papers will be one by Dr. Nansen on his Arctic journey and its results, and another by Professor Chun on the German Deep-Sea Expedition. A report will be presented by Professors Bauschinger, Mehmke, and Schülke on the decimal division of hours and angles.

Professor Hann records in the *Meteor. Zeitschrift* an extraordinary rainfall at the base of Cameroons Peak. The mean annual rainfall at Debundja, altitude 16 feet, as determined by three years' observations, is 370 inches. This rainfall has a primary maximum in June, and a secondary maximum in September. At Bibundi, a little more than half a mile from the ocean and about 10 feet above it, the rainfall in the year 1897 was 412 inches. These rainfalls are only exceeded at Cherrapunji, where the annual amount is 474 inches—*Science*, No. 238.

The steamer *Albatross* of the U.S. Fish Commission is gone to the Pacific with a scientific staff. About the middle of August it was to proceed directly to Tahiti, and on this trip of 3500 miles dredge and sound on an almost unexplored section of the sea-bottom. After spending six to eight weeks among the Pamnotu islands, the Tonga islands will be visited, and then the Fiji and Marshall islands. Between the Marshall and Hawaii islands, a distance of over 4000 miles, dredgings will be executed and tow-nets used. The *Albatross* is expected to return to the United States next April after a cruise of 20,000 miles. The scientific staff is under the supervision of Professor A. Agassiz.—*Science*, June 9th.

Mr. J. B. Tyrrell has contributed a paper to the *Bull. of the Geological Society of America* on the glaciation of the Yukon district. The glaciation was in earlier times much more extensive than at present, but even then the high mountains projected above the ice-fields, which reached only to about lat. 62° N. The characteristic feature of the glaciation was, as now, the development of valley glaciers, some of them reaching a depth of 2000 to 3000 feet. By their deposits numerous lakes were formed, while beyond the glaciated region no lakes occurred. The fact is then proved by this and other observations that the north-west of America and northern Asia were never covered by ice-sheets comparable to those of the Glacial Period in Europe.—*Bull. of the American Geographical Society*, No. 3.

M. Ch. de la Roncière has recently been led by an inspection of a ship's inventory of the year 1294 to inquire into the early use of the compass in the western Mediterranean. Flavio Gioja, he concludes, is a myth, and he controverts the date and place of the invention usually given. The word *boussole* is of Sicilian origin and originally denoted a small wooden box, perhaps of boxwood. Since also the fleur-de-lis cannot have been placed on compasses to mark the north before it was used in the Two Sicilies under the French princes of the house of Anjou in the 14th century, it seems that the compass must have been invented in the kingdom of Naples. In 1294 there were on board the *Saint Nicolas* of Messina two marine reeds or needles with their accessories. What the latter were is unfortunately not stated.—*Ciel et Terre*, Aug. 1st.

Since the height of the Ljubeten in the Šar mountains was determined by the Military Geographical Institute of Vienna as 10,006 feet, this mountain has been considered to be the highest point in the Balkan peninsula, though Professor Cvijić, who ascended it in 1891, gave the height as only 8990 feet. In the latest volume of the *Report* of the Institute, Field-Marshal von Steeb publishes a series of recent barometrical and trigonometrical measurements, from which it appears that the height certainly does not exceed 8366 feet, and that probably 8235 feet is within 30 feet of the exact figure. Consequently the Ljubeten is not the culminating point of the peninsula, being much lower than Olympus, 9790 feet (the exact height is doubtful), the Musallah in the Rila mountains, 9590, and the Perim mountains, 8796 feet.—*Geogr. Zeitschrift*, No. 6.

The regulation of the Danube at the Iron Gate has proved a failure. Its object was to remove the great obstacles to navigation on the lower Danube and facilitate communication by water with the Black Sea. It appears that between the cataracts called the Jutz and Greben are reefs and bars, disregarded in the original plan, which are still a hindrance to navigation, and that the Danube canal, which, in the opinion of all foreign experts of any repute, ought to have had locks, has completely failed to accomplish its purpose. Not only is the voyage upstream rendered almost impossible by the velocity of the current, but the navigation on the Danube itself has fallen off owing to the canal. While formerly the passage over the reefs had to be given up when the meter at Oršova marked about four feet, it now becomes impossible when the water falls to about eight feet. Moreover the dues increase the cost of transport by more than 17d. per ton, and consequently the freightage from the Black Sea to Germany is dearer by the Danube than by sea to Venice and through Munich.—*Geogr. Zeitschrift*, No. 6.

NEW BOOKS.

A Russian Province of the North. By Alexander Platonovich Engelhardt, Governor of the Province of Archangel. Translated from the Russian by Henry Cooke. With Illustrations after Photographs by Messrs. Leitginger of Archangel and Engineer Podgaetski, and Three Maps. London: Archibald Constable and Co., 1899. Pp. xix + 356. *Price* 18*s.*

In giving to English readers Governor Engelhardt's account of the great North Russian province that he has administered for several years, Mr. Henry Cooke has performed a distinctly useful piece of literary geographical work. The province of Archangel covers an area of over 200,000,000 acres, supporting some 350,000 souls, and it was in order to form some acquaintance at first hand with this immense territory, and to study certain economical problems on the spot, that the energetic governor made the journeys a record of which composes the substance of this book. These facts at once suggest the limitations of the volume. Little impartiality is shown in the matter of judgment, and the whole is steeped in that spirit of careless optimism so characteristic of the superior Russian official. On the other hand, we see things at their best, and in the perusal of these brightly written chapters come to have very definite, fresh ideas of this Russian province of the north.

Engelhardt first seeks to emphasise the modern value of these northern regions. Interest in them was shown as early as the time of Peter the Great, but with the exploitation of the Volga, trade went towards the Baltic and the north was abandoned. But apart from the fishing, timber, metallurgic, and shipbuilding

industries that now as then (in part) flourished in the Arctic province, it is important to note that the White Sea with the Arctic is the only ocean basin that Russia can really call her own, whence "from the ice-free waters of the Murman, with its beautiful harbours, sheltered by impregnable rocks of granite, could a Russian fleet at any season of the year put to sea, free and unfettered, and gain access to the broad ocean and all the countries of the world." The greater part of a chapter is taken up with the description of just such a new naval and commercial harbour at Ekaterina in the Gulf of Kola, which was formally opened in July of this year, and whither are to be transferred the official administration of the whole Murman coast, as Kola, the old bureaucratic centre, at the head of the gulf of the same name, is now considered to be too far inland. Agriculture, except in certain southern districts where one and a half million poods of grain may be grown in a good year, is practically impossible. The population requires at least three and a half million poods, and the normal deficit of two millions, much greater in bad years, must be imported. This affords ample scope for grain-holders and monopolists. Hence the most pressing needs are the cheapening of grain and the development of the various trades and industries by means of the establishment of an assured outlet—railway or steamboat communication—for this produce.

Archangel lies 700 miles north of Moscow, which has for some years been connected by rail with the intermediate station of Vologda. In 1895 a commencement was made of laying rails over the remaining 396 miles ; in two years the task was accomplished. Moreover, the railway from Kotlass, on the Northern Dwina, to Viatka and Perm, originally undertaken with the object of helping Siberia to export her corn without at the same time flooding the already crowded Russian markets, will also benefit the northern province. Begun in 1896 and now completed, it will practically connect the basins of the Ob and Dwina, and thus be an important factor in the unification of the great empire.

A chapter is devoted to each of the districts of the province, briefly pointing out general features and enlarging upon topics of specific interest. Thus we learn that in the district of Kem the timber trade is the main support of the people, since while rye and barley, potatoes and turnips, may be raised in small quantities, agriculture is a pretty hopeless struggle against Nature. The inhabitants of this region are Korelyans, allied in speech and race to the Finns. Conservative and backward (although you will not find a single vodka tavern in their villages), they are a striking contrast to the neighbouring Pomors, descendants of settlers from Novgorod, enterprising and daring fishers. At five centres on the Murman coast their annual catch of herring is twenty-five million. Shipbuilding is their winter occupation. "Like all the sawmills of the White Sea, it (Kovda) is lit with electric light." In the course of one journey Engelhardt paid a visit, as was to be expected, to the famous Solovetski monastery. He gives an interesting account of this remarkable self-governing social community, independent of all civil authority, and possessing, in addition to its steamers for the conveyance of pilgrims, the only dry dock in the White Sea, which is consequently in constant requisition.

Russian Lapland, or the interior of the Kola peninsula, has of course an incipiently Arctic climate. Winter reigns from the end of September to the beginning of May. The Polar night (Nov. 28 to Jan. 15) is not, however, a period of utter darkness. The summer is inversely brief. From May 24th to July 21st the sun never sets, and the flowers, growing rapidly in the unbroken daylight, as quickly shed their blossoms. The Lapps lead a semi-nomadic life. Putting no great value on their tribal individuality, they are being gradually absorbed by neighbouring races. At the same time Engelhardt would contradict all notions of

misery and privations in the Lappish lot. On the contrary, they are content and happy, and would not readily accommodate themselves to the more civilised conditions under which well-wishers would prefer to see them existing. Their chief occupations are reindeer-rearing and fishing, and in winter the transport of goods by means of their deer.

Novaya Zemlya, the double island with a total length of 666 miles and an average breadth of 133, "is a continuation, so to say, of the Urals, *i.e.* of the Pai-Hoi range." "Unquestionably" it was discovered by Russians, although when and by whom is more than even the worthy governor can say. Bleak and bare, devoid of trees unless in the south, where the willow and creeping Polar birch are found, with the valleys covered alone with moss and withered-looking grasses, Novaya Zemlya would seem to offer little attraction to settlers, but Engelhardt has made a beginning, principally with Samoyedes, and in May 1898 the population of this inhospitable land was 110. The mean annual temperature on the west coast is given as $-8{\cdot}37^{\circ}$ C., which is found to be higher than that of Ustiansk, in north-east Siberia, where "people have settled down comfortably enough from time immemorial." But on this point he can hardly have consulted the exiles who form the majority of these unfortunate "people." The coal reported to be found in Novaya Zemlya is shown to be lignite ; consequently Archangel will continue to be dependent upon England for her supply of that commodity.

The last journey was made through the Petchora country, which, with the associated district of Mezen, extends over nearly 130,000,000 acres. "The main avocations of the inhabitants are marine animal hunting, fishing, forest sport, and work connected with the sawmills, such as the felling and floating of timber." The chapter contains an interesting account of the Samoyedes, who seem to be "a transition-stage between the Mongol pure and the Finn." Although the name Samoyede was familiar to the Russians in the eleventh century, its derivation is uncertain. They are a nomadic people, and, contrary to the general impression, are not dying out. With their herds of from forty to fifty reindeer the Samoyedes roam over the tundra. Under such circumstances the following acquired character must be distinctly useful: "When his larder is full, he eats largely and voraciously, but is capable of fasting for days at a time when his stock runs low." It is calculated that the combined reindeer herds of the Samoyedes and the more progressive allied Ziryans number about 300,000 head.

The book contains three maps, and an appendix with economical statistics for the years 1893-1897. The illustrations are excellent.

Från Eldslandet. Skildringar från den Svenska Expeditionen till Magellansländerna, 1895-97, samlade af Otto Nordenskjöld. Stockholm: P. A. Norstedt och Söners Förlag, n.d. In four parts. *Price* 1 *kr.* 6 *öre each.*

Dr. Otto Nordenskjöld describes in detail the incidents of his travels in Tierra del Fuego and Patagonia, of which he gave some geographical notes in the *S.G.M.*, vol. xiii. p. 393. Here he dwells little on scientific results, merely remarking that the chief objects of the expedition were to investigate the ancient glaciation of Tierra del Fuego and collect fossils which might throw some light on the changes of climate in the glacial and inter-glacial periods. These have not yet been thoroughly examined, and, indeed, will occupy specialists for some time to come.

The work before us is written rather for general readers, and describes his wanderings over the northern plateau of Tierra del Fuego, his journey inland to Lake Fagnano, his visit to Ushuaia, and his ascent of the Azopardo river to Lake

Fagnano, his expedition from Punta Arenas to Lake Sarmiento and also the towns of Valparaiso and Santiago and the mines of Atacama. There is therefore no lack of variety, and the interest is well maintained.

The Ona Indians he was not able to observe in their wild state as they are exceedingly shy, especially since their propensity for sheep-stealing has put a barrier between them and the white settlers. But from the individuals employed at the sheep-stations and elsewhere, Dr. Nordenskjöld describes them as a fine well-proportioned race, averaging in height 5 ft. 7 in. Their intellectual powers also are by no means despicable; they soon pick up a little English and Spanish, and make themselves useful to their employers. The Yaghans on the Beagle Channel are a much inferior race. What civilisation they have acquired from the missionaries does not appear to have greatly improved them, while measles and other diseases of civilised races have rapidly reduced their number, so that now there are at most 300 remaining, and the race will very shortly disappear.

Dr. Nordenskjöld speaks very highly of the Chilians, whom he describes as in many respects the most advanced among Latin peoples outside Europe. He was certainly well treated by the Chilian Government, a gunboat being sent out in search of the expedition as soon as its arrival was known, on which he made several voyages among the islands of Tierra del Fuego.

Från Eldslandet is a capital book for all readers who wish to learn something of the southern part of South America and the life of the natives and settlers, and, were it translated into English, ought to be much sought after. It is accompanied by a good map and many excellent illustrations.

Highways and Byways in Donegal and Antrim. By Stephen Gwynn. London: Macmillan and Co., Ltd., 1899. Pp. 319.

When a Donegal man of Mr. Gwynn's eminence comes to write of his native county one may be sure of a good book, and this one is excellent reading. Its design is that of a guide-book, and the distances, routes, hotels, and cycling qualities of roads are duly recorded. Its weight, however, renders the volume somewhat unhandy for this purpose. But it appeals to a much wider circle than travellers only. The descriptions are spirited, and the information ranges over all ages and subjects in true Irish style—fishing, antiquities, local characters, industries, tales of history and of fairy land and, by no means least, the Congested Districts Board. It is cheering to learn that in Mr. Gwynn's view the work of this Board, with the introduction of capital into local industries, is effecting a steady improvement in the conditions of peasant life, and shows potentialities of still better things. In some parts it may be noted there are still natives who can speak no language but Irish, and many who speak English with difficulty. But, with the advent of golfers and anglers (for whose benefit Mr. Gwynn supplies a special chapter) and other visitors, this must gradually change. The illustrations from the pencil of Hugh Thomson are one of the attractions of the book, especially the views of coast scenery. A map at the end shows the district, but curiously enough omits the name of so important a town as Moville.

The Geography of Mammals. By William Lutley Sclater, M.A., F.Z.S., Director of the South African Museum, Cape Town, and Philip Lutley Sclater, M.A., Ph.D., F.R.S., Secretary to the Zoological Society of London. 8vo. Pp. xviii+335. With Fifty Figs. and Frontispiece. London: Kegan Paul, Trench, Trübner and Co., Ltd., 1899. *Price* 12*s. net.*

In 1857 Mr. P. L. Sclater proposed a zoo-geographical division of the earth into six regions, and his system was followed by Mr. Alfred Russel Wallace in

his great work on distribution. Since 1857 many new facts have been brought to light—by Mr. Sclater himself not a few—and as to the old facts many a change of interpretation has been necessitated, especially by the progress of palæontological research. Mr. Sclater, however, adheres consistently to his old system, not indeed refusing to consider the criticisms which have been brought forward, but declining to accept them as justified. Whether he is right in so doing is a question for individual judgment, and we cannot conceal our disappointment that he and his son have been so conservative. In a fairly big book, with Mr. P. L. Sclater as joint author, the student might, we think, justly expect a more serious discussion of the emendations that have been suggested by many capable authorities. We do not understand, for instance, why no notice is taken of Mr. Lydekker's recent work on the same subject, which leads the student to conclusions in many respects different from those of the authors. It may be noted, however, that the first seven chapters in the volume (by Mr. W. L. Sclater) were published in the *Geographical Journal* (1894-1897), and have only been slightly altered—a fact which would be of little importance if the subject were theology, but which, with a subject like this, may serve to explain some strange errors of omission and commission. For it should be recollected, as the preface says, "that science in all its branches moves fast nowadays, and that statements which are perfectly correct one day may be falsified at any moment by new discoveries and by fresh investigations." In many books one can acquaint oneself with the general facts regarding the distribution of mammals, and we are disappointed that the Messrs. Sclater have not given us something less cut and dry, something more richly seasoned with ideas. It may be, however, that their reserve and conservatism have ampler justification than we are aware of.

The book is admirably arranged, lucidly expressed, abundantly supplied with terse summaries, beautifully illustrated by Smit, and accompanied by eight clear maps. It will be of great service to students, especially if the passages which suggest finality be read with judicious scepticism.

The plan of the volume is as follows:—a general introduction, six chapters devoted to the six regions, an interpolated chapter on marine mammals (perhaps the most vigorous part of the book), and then seven chapters on the distribution of the various orders of mammals. The first six chapters have lists of the principal authorities referred to; each of the last seven ends with a summary and deductions. The lists of genera and the tables of their distribution will be found very useful to the serious student.

The final conclusions may be cited: "Thus we see that whether we take the Mammals in Geographical or in Systematic order, we arrive at nearly the same result—namely, that the best Primary Geographical Divisions of the earth are six in number. Of these the Australian Region (*Neogæa*), in which the Mammal-fauna is pre-eminently Marsupial, and embraces the whole order of Monotremes, is by far the most distinct. It is, however, also easy to separate the Neotropical Region (*Notogæa*), with its one family of Marsupials and numerous Edentates. The remaining Regions (*Arctogæa*) may be grouped together, but are still separable—on more slender grounds, it is true, into four divisions—the Ethiopian Region, remarkable for its abundant Ungulates, the Giraffe, and the Hippopotamuses; the Oriental, known by its Orangs, Gibbons, and Tapir; and the Palæarctic and Nearctic, which, no doubt, present many points of similarity as regards their Mammal-faunas, but may nevertheless be properly kept apart. The Nearctic Region, as has been shown above, has been overrun by an inroad from the northern portion of the Old World, but has a strongly developed under-stratum of endemic forms mixed up with some Neotropical types, which are utterly foreign to the Palæarctic Region."

With one of the authors in London and the other in Cape Town—and both busy with many affairs—the unification of the book must have presented difficulties, and it can hardly be said that these have been adequately overcome. Thus the authors do not seem to be of one mind in regard to the help afforded by the hypothesis of a former land-connection between Southern India and South Africa. At one place we hear of eleven orders of mammals and at another of fourteen. The student is first introduced to the Primates, and later on to the Quadrumana and Lemures, and the same genus is not always called by the same name. These things ought not so to be.

Blemishes apart, we have here a work of much interest and usefulness, especially as it expresses the deliberate conclusions of the senior author, who has for over forty years been enriching zoology, and this particular department of it, with valuable results.

Man: Past and Present. By A. H. Keane, F.R.G.S. ("Cambridge Geographical Series.") Cambridge: At the University Press, 1899. Pp. xii + 584. With Portraits and Diagrams. *Price* 12*s.*

What impresses one most of all in turning over the pages of Professor Keane's admirable work is the immense amount of learning it embodies; and scarcely less remarkable is the lively and interesting manner in which this mass of information is brought before the reader. Within the present limits it is hardly possible to give anything like an adequate analysis of a book so comprehensive in its scope. Briefly, it is a survey of all the existing races of mankind, considered successively in their main groups; the account of each group being preceded by a *conspectus* of their Primeval Home, Present Range, Physical and Mental Characteristics, and an enumeration of their Main Divisions. And the people themselves are regarded from every point of view; science, religion, folklore, sociology—all are made to yield up their treasures for the enlightenment of the reader.

Not the least interesting portion of the book is that relating to one of the greatest discoveries of the present century, namely, the co-existence in Switzerland of a dwarf race in friendly relation to people of average European stature, at some unascertained date. In this connection the author quotes Professor James Geikie's observation (in our *Magazine* of Sept. 1897): "It is possible, as Dr. Nüesch suggests, that the widely-spread legend as to the former existence of little men, dwarfs and gnomes, who were supposed to haunt caves and retired places in the mountains, may be a reminiscence of these Neolithic pygmies." If that were so, one manifest deduction is this: either popular tradition has its origin in a remote period of antiquity, or else the dwarf people referred to existed in comparatively recent times.

The various typical portraits, which are reproduced from photographs, are excellent and instructive. One closing remark, by way of criticism, may be permitted, although it relates only to a very minor detail. On p. 355 the terms *a priori* and *a posteriori* are given a French appearance by a superfluous accent over the *a*; a common error, often due to the printer, as perhaps in this case.

The Philippine Islands. A Political, Geographical, Ethnographical, Social, and Commercial History of the Philippine Archipelago and its Political Dependencies, embracing the whole period of Spanish rule. By John Foreman, F.R.G.S. Second edition, revised and enlarged. London: Sampson Low, Marston, and Co., 1899. Pp. 653. *Price* 21*s.*

The author warns us that this very readable and instructive book is "not a

history, nor a geography, nor an account of travels in the strict sense of the word; it is a concise review of all that may interest the reader who seeks for a general idea of the condition of affairs in this colony in the past and in the present." His qualifications for writing it were long years of personal acquaintance with some of the active movers in the Revolutionary Party; his associations with Spain and Spaniards since his boyhood; and his connection with the American Peace Commission in Paris, which afforded him "an opportunity of appreciating the noble efforts of a free people to raise the weight of monastic oppression from millions of their fellow-creatures." The chapter entitled "The Monastic Orders" reads like a page of ecclesiastical history previous to the Reformation, the multitude, immorality, intrigues, and dissensions of the Friars in the Philippines being vividly exposed.

With regard to the capital, Manila, we are told that its climate "may be generally summed up as follows, viz.: December, January, and February, a delightful spring; March, April, and May, an oppressive heat; June, July, August, and September, heavy rains; October and November, doubtful, sometimes very wet, sometimes fairly dry. Briefly, as to climate, it is a pleasant place to reside in." In Manila city and wards there were in 1896 about 340,000 inhabitants, of which the ratio per cent. would be:—Pure natives 68, Chinese half-breeds 16·65, Chinese 12·25, Spaniards and Creoles 1·65, Spanish half-breeds 1·30, foreigners (other than Chinese) 0·15. Total 100.

Severe typhoons and destructive earthquakes visit Manila periodically. Mosquitoes also abound, coming from the numerous malarious creeks. Thanks to the Spanish Government, Manila enjoys since 1884 an excellent supply of good drinking water. A map of the Philippines and illustrations accompany the volume, which also contains the text of the Treaty of Peace concluded between the U.S.A. and Spain, signed in Paris on 10th December 1898, whereby the Philippine Islands were ceded to the United States, as well as Porto Rico, etc., in the West Indies, and the island of Guam in the Marianas or Ladrone archipelago, whilst Spain renounced her rights over Cuba, which was then to be occupied by the United States, the latter agreeing to pay the sum of twenty million dollars.

The West Indies. A History of the Islands of the West Indian Archipelago, together with an Account of their Physical Characteristics, Natural Resources, and Present Condition. By Amos Kidder Fiske. New York: Putnam's Sons, 1899. Pp. xii + 414. *Price* 6s.

The recent concentration of public attention on the West Indies, especially in the United States, has lead Mr. Fiske to compile a handy account of the history and geography of these islands. The book is strongest on its historical side. The first hundred pages are devoted to the general history of the Antilles, and then each island is described in detail, first as to physical characteristics, and next as to its history and present conditions. The geographical part of the work is very well compiled, although it naturally cannot be classed with Mr. Hill's original work recently reviewed in the *Magazine*. There are a few minor errors. The fossil quadrupeds of Cuba have no relationship to North American species, and much of the limestone of that island is not coralline. The mean rainfall at Havana is given a few inches too low. Mr. Hill's value is too high. According to Dr. Hann, the average for twenty and a half years is 1175 mm. (46·2 inches). On the whole, the book is a reliable and readable summary about a region hitherto rarely dealt with as a whole.

The book is seasonably illustrated, and contains simple maps which a little

more trouble and comparison with the text would have improved. The book would also be the better for a list of references, which we hope Mr. Fiske will add in a second edition.

Steam Navigation and its Relation to the Commerce of the United States and Canada. By JAMES CROIL. Toronto: W. Briggs, 1898. Pp. 381.

Mr. James Croil's, of Montreal, volume on steam navigation and its relation to the commerce of Canada and the United States is a useful little book, which we would recommend to the notice of any one who takes an interest in maritime locomotion. He gives a most interesting account of the transition scenes from the days of the old sailing ships until the present time, when the Atlantic can be crossed by the Ocean Greyhounds in less than six days, vividly showing to the reader the changes that have taken place during the last half century. He gives short summaries of the rise and progress of the Cunard and other steamship companies, and also anecdotes of the founders and captains connected with these great ocean lines, which will be found of interest to past, present, and future travellers by the sea routes, more especially to those for the North American continent.

Mr. Croil also mentions in his book, "Great as have been the changes brought about by steam navigation applied to commercial uses, the transformations of the navies of the world have even been more remarkable," and he proceeds to give a short description of the changes initiated in the British navy during Queen Victoria's reign. He devotes his last four chapters to information about, and histories of, the numerous waterways (rivers, lakes, and canals) in Canada, etc., imparting much useful knowledge for commercial purposes of water carriage of passengers, goods, etc. Much that appears in Mr. Croil's work is already known, and, as he says in his preface, "has been gathered from various sources," but nevertheless we can strongly recommend the book as one full of valuable information on the subject of which he treats.

Man and his Work. An Introduction to Human Geography. By A. J. HERBERTSON, Ph.D, Assistant to the Reader in Geography in the University of Oxford and Associate Editor of *The Journal of School Geography*, and F. D. HERBERTSON, B.A. London: A and C. Black, 1899. Pp. 118. *Price* 1*s.*

In this small volume the authors sketch out the relations of man to the countries he inhabits. The most general factors affecting the life of man, such as climate, elevation, vegetation, etc., are briefly noticed, and then the characteristics of various parts of the Earth's surface, such as tundras, steppes, deserts, forests, etc., are described as they modify the habits and occupations of their inhabitants. The next chapters deal with these occupations, beginning with hunting and fishing, which supply the sole means of subsistence to the most primitive races, and passing on to pastoral life and the development of agriculture and manufactures, which latter are intimately connected with trade and transport. Lastly, the density of population and migration are shown to depend on the utilisation of the resources of land and sea.

The book exhibits, of course in general outlines, the development of man under the influence of natural forces and shows the close dependence of man on his surroundings. It is an admirable introduction to anthropogeography, and calculated to impress on the pupil the importance of the subject.

Die Kolonialpolitik Grossbritanniens. Zweiter Theil. Vom Abfall der Vereinigten Staaten bis zur Gegenwart. Von Dr. Alfred Zimmermann. Berlin: Mittler und Sohn, 1899. Pp. 399 and Bibliography. *Price M.* 9; bound *M.* 10.50.

In December of last year (p. 676) we had the pleasure of giving a favourable notice of the first volume of Dr. Zimmermann's work. We are glad to say that the second volume again shows the author's scholarship, industry, and fairness.

He states facts and leaves his readers to draw their own conclusions—would that more authors would do the same! Apart from general literature, Dr. Zimmermann has been a diligent student of British bluebooks, and calls attention to their frequent groundless inconsistencies.

This volume treats of the colonisation of Africa, of the West Indies, North America, Asia, and Australasia, with an introductory chapter on the rise of British over-sea rule, and concludes with one on British Colonial rule and policy in general.

Needless to say, in dealing with such a wide field our author has been unable to enter into detail, and yet he has managed to tell his story with clearness and without the omission of vital facts, and the student will be surprised to find so much in such a brief compass.

A book on these lines is still wanted in our own language; this one will doubtless prove of very considerable value to those for whom it is specially written. We may repeat the last sentence of our former notice: "A detailed review of this volume is not necessary, but we can thoroughly recommend it to our readers."

The History of South America from its Discovery to the Present Time. Compiled from the Works of the Best Authors and from Authentic Documents, many hitherto unpublished, in various Archives and Public and Private Libraries in America and Spain, by an American. Translated from the Spanish by Adnah D. Jones. London: Swan Sonnenschein and Co., 1899. Pp. 345.

After a brief review of the discovery of America, and the conquest of the country by the Spaniards and Portuguese, the author relates the events which took place in each State after the outbreak of the revolt against the Spanish Crown. The history of these States consists, as is well known, of a succession of revolutions which continued without interruption up to the time when this book was written—fully thirty years ago. Before the Spanish yoke was completely cast off, Federalists and Unitarians, or as they would be called in the United States, Democrats and Republicans, began to struggle for the mastery, and neighbouring States quarrelled over their common boundaries, this party strife being frequently made use of by ambitious adventurers to promote their own ends. The history affords an example of the anarchy into which a people falls which suddenly acquires liberty, having had no experience in the management of their own affairs, and therefore unaccustomed to self-control. Brazil, though it passed through some troublous times, was on the whole more fortunate than the Spanish colonies, for it possessed a hereditary monarchy, and therefore was not at the mercy of every agitator who could manage to raise himself to the head of a party.

The American author is severe in his censure of the Spanish authorities for their tyrannous administration and their cruelty to the Indians, but perhaps from a desire to show himself impartial—a quality to which he frequently lays claim—he endeavours to prove that the Indians in North America were still more badly treated, bringing forward the fact that their numbers have been reduced far below those of the South American tribes. This is no criterion, and the author would

have found a better excuse for the excesses of the Spanish colonists in the history of the nation and of the American conquest, the climate, etc.

As regards the events which took place in the South American States during this century the author seems to be well informed. In other matters he sometimes shows ignorance. For instance, he does not mention Toscanelli in connection with the voyage of Columbus, and does not allude to the Papal Bull of 1494, which moved the boundary between the Spanish and Portuguese spheres of conquest to 370 leagues east of the Azores, and in virtue of which Portugal claimed Brazil. On p. 329 he makes the rash statement: "In the United States of North America there are no half-breeds."

La Géographie Militaire et les Nouvelles Méthodes Géographiques. Introduction à l'Etude de l'Europe Centrale. Par O. Barré, Chef de Bataillon du Genie. Paris et Nancy: Berger Levrault et Cie., 1899. Pp. 79.

The author, who is a Professor at the Military School of Fontainebleau, states that "a great dispute embroils geographers at present. On the one hand, the *literary* geographers, who till now have ruled education, protest against the invasion of the territory they regard as their own, and imagine all kinds of evils resulting from the abandonment of their purely descriptive methods. On the other hand, the *scientific* geographers advance to the assault of the position and wish to establish their *geomorphogenic* method. Military geographers cannot remain neutrals," and the author maintains that they must adopt the scientific method, which does not mean those "little geological observations which are often out of date and misleading, and which stud our treatises, but those geomorphogenic considerations" which relate to the rational study of the forms of the Earth's surface derived from three primordial causes, (1) the nature of the materials of the surface, (2) the architectural order established by the mechanical movements which have revolutionised the surface of the globe, and (3) the sculpture given to that architecture by external agencies. After pointing out that the structure of a district can only be understood by reference to its geological history, the author discusses the chief lines of the geographical evolution of Central Europe, and states that its present configuration dates from the Tertiary epoch. He insists that the teaching of geography must be reformed in the direction of physiography, and that to understand a country we must study its structure, denudation, and the effects produced on it by vegetation and the circulation of water. Three maps and thirty-seven diagrams illustrate the method of geographical teaching advocated and practised by Professor Barré.

Holland and the Hollanders. By David S. Meldrum. Edinburgh and London: Blackwood and Sons, 1899. *Price 6s.*

This book contains an excellent account of Holland as it now is. In any description of Holland the prevailing feature must be what Mr. Meldrum calls "the fight with the waters," and to this very important branch of his subject he does ample justice. His descriptions of how lands, often amounting to provinces, have been reclaimed from the sea, how they are retained, and how the ocean is prevented from submerging half the country, are very interesting, and have the merit of being easily understood, although the subject is by no means one which readily lends itself to ordinary description. We have also light sketches of how Holland is now governed, and how it is educated, and brief descriptions of some of the principal cities. Incidentally we are introduced to the prison at Breda, where the system is one of solitary confinement, carried out with a rigour which would not

be tolerated here, and to the Veenhuizen colonies, where some three thousand tramps and beggars are kept at a cost to the state of £30,000 a year. There is also an interesting account of the rise of the Dutch fisheries, and the improvements which have been made from time to time in the fishing fleets. The book is profusely illustrated from pictures by well-known Dutch artists.

In Modern Spain. Some Sketches and Impressions. By Reginald St. Barbe. London: Elliot Stock, 1899. Pp. 95.

This prettily illustrated little book contains a "collection of fugitive sketches" made by the author from his experience of Spain. He tells us that "the morals of the Spaniard are flabby," and that the "eternal black eyes and hair" of the Spanish ladies "makes one long for a shock of red hair."

Die Insel Pemba und ihre kleinen Nachbarinseln. Von Dr. Oscar Baumann. Mit einer Originalkarte. Leipzig: Duncker und Humblot, 1899. Pp. 15. Map. *Price 80 pf.*

With this third instalment Dr. Oscar Baumann concludes his work on the Zanzibar Archipelago. It is a short description of the history, geology, climate, vegetation, people, and trade of the island. It gives all needful information, but is not quite so exhaustive as his two previous monographs; this is due to the author's illness during his exploration of the island. He mentions that the trade is decreasing owing to want of labour—the slave population is much less than it was. The map, 1:320,000, based upon the British Admiralty Chart, is satisfactory.

Koloniales Jahrbuch. Herausgegeben von Gustav Meinecke. 4 Hefte. *Die Ramiefaser und die wirtschaftliche Bedeutung der Ramiekultur für die deutschen Kolonien.* Von A. Schulte im Hofe. Berlin: Deutscher Kolonial-Verlag, 1898.

The *Koloniales Jahrbuch*, published by the editor of the *Deutsche Kolonialzeitung*, contains many valuable articles, some of which are of general interest. Such is that on the training of Papuans as labourers, which may be read with advantage by all who have to do with uncivilised tribes, wedded as they almost always are to their primitive modes of agriculture and manufacture. Another important subject briefly noticed in the *Jahrbuch*, the cultivation and preparation of Ramie fibre, is more exhaustively dealt with by Dr. Schulte in a separate pamphlet. Better known in this country as China grass, or by the Indian name Rhea, this product occupied for many years the special attention of the Indian Government. It is, however, only in a few districts of India that it can be grown with any measure of success, as it requires a heavy and fairly equally distributed rainfall. Dr. Schulte considers that it would find a congenial climate in tropical West Africa, and might be grown there with profit, as it could be cut six times a year. It is the longest, stoutest, and most durable of fibres, and since machines have been invented which satisfactorily remove the fibre from the cortex, and methods of cleaning it have been elaborated, it has been woven into table linen, plush, upholstering materials, etc. But, being chiefly exported from China, where the plant can be cut only three times a year, it sells at as high a price as the finest flax, and cannot therefore be used extensively. In West Africa, according to Dr. Schulte, it could be produced much more cheaply.

Mediterranean Winter Resorts. By EUSTACE A. REYNOLDS-BALL, F.R.G.S. Fourth edition. London: Kegan Paul, 1899. Pp. 537. *Price* 6*s.*

This greatly enlarged edition contains useful notes for tourists and invalids on the French Riviera, the Italian Riviera, Florence, southern Italy, the south of Spain, Morocco, Algeria, Egypt, and the Mediterranean islands. The author, however, has fallen into the common error of accepting Messrs. Cook's temperatures of Luxor (Egypt) without noticing that no year is stated, and without doubting their reliability. The daily range of temperature during January and February is given by Messrs. Cook as only a few degrees, whereas, as a matter of fact, it may be 20° or 30°,—an important difference for invalids.

Hints and Notes, Practical and Scientific, for Travellers in the Alps. By the late JOHN BALL, F.R.S., etc., President of the Alpine Club. A new edition prepared on behalf of the Alpine Club by W. A. B. COOLIDGE. Pp. 164. *Price* 3*s. net.*

The new edition of this well-known book has been revised under the supervision of Mr. Coolidge, whose thorough knowledge of the Alps is a guarantee of the accuracy of the work. Many additions and alterations have necessarily been made. The chapter on the Geology of the Alps has been rewritten by Professor Bonney, and Photography in the High Alps has been treated of by Mr. Sydney Spencer. The work is therefore almost a new one.

Putevoditel po vsei Sibiri. (Guide to all Siberia and the Russian Possessions in Central Asia.) Third Year. By W. A. DOLGOROUKOFF. Tomsk: P. I. Makushin, 1898. 1 *rouble.*

Dorojnik po Sibiri i Aziatskoi Rossii. (Itinerary through Siberia and Asiatic Russia.) Books I. and II. Tomsk: Makushin, 1899.

These books are issued from the same press, and are in a sense complementary to one another. The larger guide is the third annual addition of the best Russian handbook on Siberia. This special edition gives a sufficient summary of the contents of each chapter in French, thus making the contents accessible to the average traveller. The most frequented routes are described in turn, and details connected with lodging, rail, and post travel are given with commendable exactness, in addition to such particulars as one would expect in a book of this nature. While the second series of brochures repeats in part certain of the details of the two-shilling guide, it really consists of a series of short chapters by specialists upon the different towns and districts of Siberia and Turkestan. There is also an account in French of the various Siberian mineral water sources, whose value is now beginning to be recognised. With the exception of the bulky "Siberian Calendar," these handbooks are the best informed works upon the Russian possessions in Asia.

The Contour Road Book of England (Devon, Cornwall, Somerset, etc.). By HARRY R. G. INGLIS. London and Edinburgh: Gall and Inglis, 1899. Pp. 497-644. *Price* 1*s. net.*

We have already noticed the *Contour Road Book of Scotland*, and the section of the present work dealing with the north of England. The excellent plan devised by the author was explained in vol. xii. p. 495. Though intended chiefly for cyclists, these little books will be found useful by all travellers by road.

Wanderungen in den südlichen Alpen Neu-Seelands. Von Dr. med. Franz Kronecker, aus Berlin. Berlin: Max Pasch, 1898. Pp. 119.

Dedicated to his colleagues in the Berlin section of the German and Austrian Alpine Club, Dr. Kronecker sets before them by means of full descriptions and excellent photographs the attractions offered to climbers by the Southern Alps of New Zealand. His own exploits, including the ascent of Mount Darwin (3035 mètres), are described with graphic force.

Il Ce-Kiang. Studio Geografico—Economico del Dott. Mario Carli. Roma: Forzani e C., 1899. Pp. xix+278. *Price L.* 5.

In the province of Che-Kiang is situated the bay of San-mun, and therefore this part of China is of special interest to an Italian. Though larger than Ireland, the province is the smallest in China proper. Its natural resources, however, are abundant and varied, and at one time Che-Kiang was one of the most densely populated and richest districts of the empire, but famines and the Tai-ping rebellion have reduced the number of inhabitants from thirty-two to only five and a half millions.

Dr. Carli has consulted a large number of authorities on China and its commerce, and has compiled a very complete account of the province as far as it is at present known to Europeans. He describes its hydrography, its coasts, with a special chapter on the bay of San-mun, its means of communication, products, and towns. Silk is a very important article, and is gathered from wild silk-worms as well as cultivated. Cotton is of hardly less importance, and at Han-kau is made into cloth, which, the author states, can bear comparison with the best English goods. It is usually found that factories under native control, as this seems to be, turn out inferior goods, such as the lower classes wear, and are not very successful. There are many other vegetable products in the province, such as vegetable tallow, pistachio nuts, dye-woods, China grass, etc., as well as ores of iron, lead, copper, and tin, which are exploited only to a very small extent. The fisheries are very productive, and salt is prepared and exported. The unfavourable effect of the salt duty on the curing of fish is not alluded to.

A sketch is given of the relations of European Powers with China, and the policy of Great Britain is very favourably judged. Dr. Carli shows that the object of the "Opium War," as it is called, was to open up the country to trade in general, opium not being mentioned in the treaty by which it was terminated. He also bears witness to the disinterestedness with which this country has obtained in its treaties with China the same privileges for all European nations; but he thinks that as the policy of Russia and France has of late years been prompted by a desire to keep the door closed rather than open, Great Britain also may be forced to consult its private interests. In this case he fears that Italy may be excluded if she has not already obtained concessions from China. Surely this apprehension is groundless. The relations between this country and Italy have always been most friendly, and would continue to be so in China.

Dr. Carli rightly insists on the necessity of introducing European control in the industries of Che-Kiang, and that the Italian Government should obtain concessions for the working of mines, which it might transfer to private individuals or companies. But he does not lay enough stress on the obstacles due to insecurity and the hopeless corruption of Chinese officials.

This book is a very valuable account of the province, and the large number of statistics it contains render it a useful work of reference. It is accompanied by a good map, with the bay of San-mun as an inset.

THE SCOTTISH

GEOGRAPHICAL

MAGAZINE.

ADDRESS TO THE GEOGRAPHICAL SECTION OF THE BRITISH ASSOCIATION, 1899.

By Sir JOHN MURRAY, K.C.B., F.R.S., D.Sc., LL.D.,
President of the Section.

(With a Map.)

IN his opening address to the members of the British Association, at the Ipswich meeting, the President cast a retrospective glance at the progress that had taken place in the several branches of scientific inquiry from the time of the formation of the Association in 1831 down to 1895, the year in which were published the last two of the fifty volumes of Reports containing the Scientific Results of the Voyage of H.M.S. *Challenger*. In that very able and detailed review there is no reference whatever to the work of the numerous expeditions which had been fitted out by this and other countries for the exploration of the depths of the sea, nor is there any mention of the great advance in our knowledge of the ocean during the period of sixty-five years then under consideration. This omission may be accounted for by the fact that, at the time of the formation of the British Association, knowledge concerning the ocean was, literally speaking, superficial. The study of marine phenomena had hitherto been almost entirely limited to the surface and shallow waters of the ocean, to the survey of coasts and of oceanic routes directly useful for commercial purposes. Down to that time there had been no systematic attempts to ascertain the physical and biological conditions of those regions of the earth's surface covered by the deeper waters of the ocean; indeed, most of the apparatus necessary for such investigations had not yet been invented.

The difficulties connected with the exploration of the greater depths of the sea arise principally from the fact that, in the majority of cases, the observations are necessarily indirect. At the surface of the ocean

direct observation is possible, but our knowledge of the conditions prevailing in deep water, and of all that is there taking place, is almost wholly dependent on the correct working of instruments, the action of which at the critical moment is hidden from sight.

It was the desire to establish telegraphic communication between Europe and America that gave the first direct impulse to the scientific exploration of the great ocean-basins, and at the present day the survey of new cable routes still yields each year a large amount of accurate knowledge regarding the floor of the ocean. Immediately before the *Challenger* Expedition there was a marked improvement in all the apparatus used in marine investigations, and thus during the *Challenger* Expedition the great ocean-basins were for the first time systematically and successfully explored. This expedition, which lasted for nearly four years, was successful beyond the expectations of its promoters, and opened out a new era in the study of oceanography. A great many sciences were enriched by a grand accumulation of new facts. Large collections were sent and brought home, and were subsequently described by specialists belonging to almost every civilised nation. Since the *Challenger* Expedition there has been almost a revolution in the methods employed in deep-sea observations. The most profound abysses of the ocean are now being everywhere examined by sailors and scientific men with increasing precision, rapidity, and success.

The recognition of oceanography as a distinct branch of science may be said to date from the commencement of the *Challenger* investigations. The fuller knowledge we now possess about all oceanic phenomena has had a great modifying influence on many general conceptions as to the nature and extent of those changes which the crust of the earth is now undergoing and has undergone in past geological times. Our knowledge of the ocean is still very incomplete. So much has, however, already been acquired that the historian will, in all probability, point to the oceanographical discoveries during the past forty years as the most important addition to the natural knowledge of our planet since the great geographical voyages associated with the names of Columbus, Da Gama, and Magellan, at the end of the fifteenth and the beginning of the sixteenth centuries.

It is not my intention on this occasion to attempt anything like a general review of the present state of oceanographic science. But, as nearly all the samples of marine deposits collected during the past thirty years have passed through my hands, I shall endeavour briefly to point out what, in general, their detailed examination teaches with respect to the present condition of the floor of the ocean, and I will thereafter indicate what appears to me to be the bearing of some of these results on speculations as to the evolution of the existing surface features of our planet.

Depth of the Ocean.

All measurements of depth, by which we ascertain the relief of that part of the earth's crust covered by water, are referred to the sea-surface;

the measurements of height on the land are likewise referred to sea-level. It is admitted that the ocean has a very complicated undulating surface, in consequence of the attraction which the heterogeneous and elevated portions of the lithosphere exercise on the liquid hydrosphere. In the opinion of geodesists the geoid may in some places depart from the figure of the spheroid by 1000 feet. Still it is not likely that this surface of the geoid departs so widely from the mean ellipsoidal form as to introduce a great error into our estimates of the elevations and depressions on the surface of the lithosphere.

The soundings over the water-surface of the globe have accumulated at a rapid rate during the past fifty years. In the shallow water, where it is necessary to know the depth for purposes of navigation, the soundings may now be spoken of as innumerable; the 100-fathom line surrounding the land can therefore often be drawn in with much exactness. Compared with this shallow-water region, the soundings in deep water beyond the 100-fathom line are much less numerous; each year, however, there are large additions to our knowledge. Within the last decade over ten thousand deep soundings have been taken by British ships alone. The deep soundings are scattered over the different ocean-basins in varying proportions, being now most numerous in the North Atlantic and South-west Pacific, and in these two regions the contour-lines of depth may be drawn in with greater confidence than in the other divisions of the great ocean-basins. It may be pointed out that 659 soundings taken quite recently during cable surveys in the North Atlantic, although much closer together than is usually the case, and yielding much detailed information to cable engineers, have, from a general point of view, necessitated but little alteration in the contour-lines drawn on the *Challenger* bathymetrical maps published in 1895. Again, the recent soundings of the German s.s. *Valdivia* in the Atlantic, Indian, and Southern Oceans have not caused very great alteration in the positions of the contour-lines on the *Challenger* maps, if we except one occasion in the South Atlantic when a depth of 2000 fathoms was expected and the sounding-machine recorded a depth of only 536 fathoms, and again in the great Southern Ocean when depths exceeding 3000 fathoms were obtained in a region where the contour-lines indicated between 1000 and 2000 fathoms. This latter discovery suggests that the great depth recorded by Ross to the south-east of South Georgia may not be very far from the truth.

I have redrawn the several contour-lines of depth in the great ocean-basins, after careful consideration of the most recent data, and these may now be regarded as a somewhat close approximation to the actual state of matters, with the possible exception of the great Southern and Antarctic Oceans, where there are relatively few soundings, but where the projected Antarctic Expeditions should soon be at work. On the whole it may be said that the general tendency of recent soundings is to extend the area with depths greater than 1000 fathoms and to show that numerous volcanic cones rise from the general level of the floor of the ocean-basins up to various levels beneath the sea-surface.

The areas marked out by the contour-lines of depth are now estimated as follows:—

Between the shore	and	100	fms.,	7,000,000	sq. geo. m.	(or	7%	of the	sea-bed)
„	100	„	1000	„	10,000,000	„	„	(or 10%	„	„	)
„	1000	„	2000	„	22,000,000	„	„	(or 21%	„	„	)
„	2000	„	3000	„	57,000,000	„	„	(or 55%	„	„	)
Over 3000 fathoms,					7,000,000	„	„	(or 7%	„	„	)
					103,000,000	sq. geo. m.		100	per cent.			

From these results it appears that considerably more than half of the sea-floor lies at a depth exceeding 2000 fathoms, or over two geographical miles. It is interesting to note that the area within the 100-fathom line occupies 7,000,000 square geographical miles, whereas the area occupied by the next succeeding 900 fathoms (viz., between 100 and 1000 fathoms) occupies only 10,000,000 square geographical miles. This points to a relatively rapid descent of the sea-floor along the continental slopes between 100 and 1000 fathoms, and therefore confirms the results gained by actual soundings in this region, many of which indicate steep inclines or even perpendicular cliffs. Not only are the continental slopes the seat of many deposit-slips and seismic disturbances, but Mr. Benest has given good reasons for believing that underground rivers sometimes enter the sea at depths beyond 100 fathoms, and there bring about sudden changes in deep water. Again, the relatively large area covered by the continental shelf between the shore-line and 100 fathoms points to the wearing away of the land by current and wave action.

On the Challenger charts all areas where the depth exceeds 3000 fathoms have been called "Deeps," and distinctive names have been conferred upon them. Forty-three such depressions are now known, and the positions of these are shown on the map here exhibited; twenty-four are situated in the Pacific Ocean, three in the Indian Ocean, fifteen in the Atlantic Ocean, and one in the Southern and Antarctic Oceans. The area occupied by these forty-three deeps is estimated at 7,152,000 square geographical miles, or about 7 per cent. of the total water-surface of the globe. Within these deeps over 250 soundings have been recorded, of which twenty-four exceed 4000 fathoms, including three exceeding 5000 fathoms.

Depths exceeding 4000 fathoms (or four geographical miles) have been recorded within eight of the deeps, viz., in the North Atlantic within the Nares Deep; in the Antarctic within the Ross Deep; in the Banda Sea within the Weber Deep; in the North Pacific within the Challenger, Tuscarora and Supan Deeps; and in the South Pacific within the Aldrich and Richards Deeps. Depths exceeding 5000 fathoms have been hitherto recorded only within the Aldrich Deep of the South Pacific, to the east of the Kermadecs and Friendly Islands, where the greatest depth is 5155 fathoms, or 530 feet more than five geographical miles, being about 2000 feet more below the level of the sea than the summit of Mount Everest in the Himalayas is above it. The levels on the surface of the lithosphere thus oscillate between the limits of about ten geographical miles (more than eighteen kilometres).

Temperature of the Ocean Floor.

Our knowledge of the temperature on the floor of the ocean is derived from observations in the layers of water immediately above the bottom by means of deep-sea thermometers, from the electric resistance of telegraph cables resting on the bed of the great ocean-basins, and from the temperature of large masses of mud and ooze brought up by the dredge from great depths. These observations are now sufficiently numerous to permit of some general statements as to the distribution of temperature over the bottom of the great oceans.

All the temperatures recorded up to the present time in the sub-surface waters of the open ocean indicate that at a depth of about 100 fathoms seasonal variation of temperature disappears. Beyond that depth there is a constant, or nearly constant, temperature at any one place throughout the year. In some special positions, and under some peculiar conditions, a lateral shifting of large bodies of water takes place on the floor of the ocean at depths greater than 100 fathoms. This phenomenon has been well illustrated by Professor Libbey off the east coast of North America, where the Gulf Stream and Labrador Current run side by side in opposite directions. This lateral shifting cannot, however, be called seasonal, for it appears to be effected by violent storms, or strong off-shore winds bringing up colder water from considerable depths to supply the place of the surface drift, so that the colder water covers stretches of the ocean's bed which under normal conditions are overlaid by warmer strata of water. Sudden changes of temperature like these cause the destruction of innumerable marine animals, and produce very marked peculiarities in the deposits over the areas thus affected.

It is estimated that 92 per cent. of the entire sea-floor has a temperature lower than 40° F. This is in striking contrast to the temperature prevailing at the surface of the ocean, only 16 per cent. of which has a mean temperature under 40° F. The temperature over nearly the whole of the floor of the Indian Ocean in deep water is under 35° F. A similar temperature occurs over a large part of the South Atlantic and certain parts of the Pacific, but at the bottom of the North Atlantic basin and over a very large portion of the Pacific the temperature is higher than 35° F. In depths beyond 2000 fathoms, the average temperature over the floor of the North Atlantic is about 2° F. above the average temperature at the bottom of the Indian Ocean and South Atlantic, while the average temperature of the bed of the Pacific is intermediate between these.

It is admitted that the low temperature of the deep sea has been acquired at the surface in Polar and sub-Polar regions, chiefly within the higher latitudes of the southern hemisphere, where the cooled surface-water sinks to the bottom and spreads slowly over the floor of the ocean into equatorial regions. These cold waters carry with them into the deep sea the gases of the atmosphere, which are everywhere taken up at the surface according to the known laws of gas absorption. In this way myriads of living animals are enabled to carry on their existence at all depths in the open ocean. The nitrogen remains more or

less constant at all times and places, but the proportion of oxygen is frequently much reduced in deep water, owing to the processes of oxidation and respiration which are there going on.

The deep sea is a region of darkness as well as of low temperature, for the direct rays of the sun are wholly absorbed in passing through the superficial layers of water. Plant-life is in consequence quite absent over 93 per cent. of the bottom of the ocean, or 66 per cent. of the whole surface of the lithosphere. The abundant deep-sea fauna, which covers the floor of the ocean, is therefore ultimately dependent for food upon organic matter assimilated by plants near its surface, in the shallower waters near the coast-lines, and on the surface of the dry land itself.

As has been already stated, about 7,000,000 square geographical miles of the sea-floor lie within the 100-fathom line, and this area is in consequence subject to seasonal variations of temperature, to strong currents, to the effects of sunlight, and presents a great variety of physical conditions. The planktonic plant-life is here reinforced by the littoral seaweeds, and animal-life is very abundant. About 40 per cent. of the water over the bottom of this shallow-water area has a mean temperature under 40° F., while 20 per cent. has a mean temperature between 40° and 60° F., and 40 per cent. a temperature of over 60° F.

It follows from this that only 3 per cent. of the floor of the ocean presents conditions of temperature favourable for the vigorous growth of corals and those other benthonic organisms which make up coral reefs and require a temperature of over 60° F. all the year round. On the other hand, more than half of the surface of the ocean has a temperature which never falls below 60° F. at any time of the year. In these surface-waters with a high temperature, the shells of pelagic Molluscs, Foraminifera, Algæ, and other planktonic organisms are secreted in great abundance, and fall to the bottom after death.

It thus happens that, at the present time, over nearly the whole floor of the ocean we have mingled in the deposits the remains of organisms which had lived under widely different physical conditions, since the remains of organisms which lived in tropical sunlight, and in water at a temperature above 80° F., all their lives, now lie buried in the same deposit on the sea-floor together with the remains of other organisms which lived all their lives in darkness and at a temperature near to the freezing-point of fresh water.

Marine Deposits on the Ocean Floor.

The marine deposits now forming over the floor of the ocean present many interesting peculiarities according to their geographical and bathymetrical position. On the continental shelf, within the 100-fathom line, sands and gravels predominate, while on the continental slopes beyond the 100-fathom line, Blue Muds, Green Muds, and Red Muds, together with Volcanic Muds and Coral Muds, prevail, the two latter kinds of deposits being, however, more characteristic of the shallow water around oceanic islands. The composition of all these Terrigenous Deposits depends on the structure of the adjoining land. Around

continental shores, except where coral reefs, limestones, and volcanic rocks are present, the materials consist principally of fragments and minerals derived from the disintegration of the ancient rocks of the continents, the most characteristic and abundant mineral species being quartz. River detritus extends in many instances far from the land, while off high and bold coasts, where no large rivers enter the sea, pelagic conditions may be found in somewhat close proximity to the shore-line. It is in these latter positions that Green Muds containing much glauconite, and other deposits containing many phosphatic nodules, have for the most part been found, as, for instance, off the eastern coast of the United States, off the Cape of Good Hope, and off the eastern coasts of Australia and Japan. The presence of glauconitic grains and phosphatic nodules in the deposit at these places appears to be very intimately associated with a great annual range of temperature in the surface and shallow waters, and the consequent destruction of myriads of marine animals. As an example of this phenomenon may be mentioned the destruction of the tile-fish in the spring of 1882 off the eastern coast of North America, when a layer six feet in thickness of dead fish and other marine animals was believed to cover the ocean-floor for many square miles.

In all the Terrigenous Deposits the evidences of the mechanical action of tides, of currents, and of a great variety of physical conditions, may almost everywhere be detected, and it is possible to recognise in these deposits an accumulation of materials analogous to many of the marine stratified rocks of the continents, such as sandstones, quartzites, shales, marls, greensands, chalks, limestones, conglomerates, and volcanic grits.

With increasing depth and distance from the continents the deposits gradually lose their terrigenous character, the particles derived directly from the emerged land decrease in size and in number, the evidences of mechanical action disappear, and the deposits pass slowly into what have been called Pelagic Deposits at an average distance of about 200 miles from continental coast-lines. The materials composing Pelagic Deposits are not directly derived from the disintegration of the continents and other land-surfaces. They are largely made up of the shells and skeletons of marine organisms secreted in the surface waters of the ocean, consisting either of carbonate of lime, such as pelagic Molluscs, pelagic Foraminifera, and pelagic Algæ, or of silica, such as Diatoms and Radiolarians. The inorganic constituents of the Pelagic Deposits are for the most part derived from the attrition of floating pumice, from the disintegration of water-logged pumice, from showers of volcanic ashes, and from the débris ejected from submarine volcanoes, together with the products of their decomposition. Quartz particles, which play so important a rôle in the Terrigenous Deposits, are almost wholly absent, except where the surface-waters of the ocean are affected by floating ice, or where the prevailing winds have driven the desert sands far into the oceanic areas. Glauconite is likewise absent from these abysmal regions. The various kinds of Pelagic Deposits are named according to their characteristic constituents, Pteropod Oozes, Globigerina Oozes, Diatom Oozes, Radiolarian Oozes, and Red Clay.

The distribution of the deep-sea deposits over the floor of the ocean is shown on the map here exhibited, but it must be remembered that there is no sharp line of demarcation between them; the Terrigenous pass gradually into the Pelagic Deposits, and the varieties of each of these great divisions also pass insensibly the one into the other, so that it is often difficult to fix the name of a given sample.

On another map here exhibited the percentage distribution of carbonate of lime in the deposits over the floor of the ocean has been represented, the results being founded on an extremely large number of analyses. The results are also shown in the following table:—

	Sq. Geo. Miles.	Percentage.
Over 75% $CaCO_3$ . .	6,000,000 . .	5·8
50 to 75% „ „ . .	24,000,000 . .	23·2
25 to 50% „ „ . .	14,000,000 . .	13·5
Under 25% „ „ . .	59,000,000 . .	57·5
	103,000,000	100

The carbonate of lime shells derived from the surface play a great and puzzling rôle in all deep-sea deposits, varying in abundance according to the depth of the ocean and the temperature of the surface-waters. In tropical regions removed from land, where the depths are less than 600 fathoms, the carbonate of lime due to the remains of these organisms from the surface may rise to 80 or 90 per cent.; with increase of depth, and under the same surface conditions, the percentage of carbonate of lime slowly diminishes, till, at depths of about 2000 fathoms, the average percentage falls to about 60, at 2400 fathoms to about 30, and at about 2600 fathoms to about 10, beyond which depth there may be only traces of carbonate of lime due to the presence of surface-shells. The thin and more delicate surface-shells first disappear from the deposits, the thicker and denser ones alone persist to greater depths. A careful examination of a large number of observations shows that the percentage of carbonate of lime in the deposits falls off much more rapidly at depths between 2200 and 2500 fathoms than at other depths.

The Red Clay, which occurs in all the deeper stretches of the ocean far from land, and covers nearly half of the whole sea-floor, contains—in addition to volcanic débris, clayey matter, the oxides of iron and manganese—numerous remains of whales, sharks, and other fishes, together with zeolitic crystals, manganese nodules, and minute magnetic spherules, which are believed to have a cosmic origin. One haul of a small trawl in the Central Pacific brought to the surface on one occasion, from a depth of about two and a half miles, many bushels of manganese nodules, along with fifteen hundred sharks' teeth, over fifty fragments of earbones and other bones of whales. Some of these organic remains, such as the *Carcharodon* and *Lamna* teeth and the bones of the Ziphioid whales belong apparently to extinct species. One or two of these sharks' teeth, earbones, or cosmic spherules, may be occasionally found in a Globigerina Ooze, but their occurrence in this or any deposits other than Red Clay is extremely rare.

Our knowledge of the marine deposits is limited to the superficial

layers; as a rule the sounding-tube does not penetrate more than six or eight inches, but in some positions the sounding-tube and dredge have been known to sink fully two feet into the deposit. Sometimes a Red Clay is overlaid by a Globigerina Ooze, more frequently a Red Clay overlies a Globigerina Ooze, the transition between the two layers being either abrupt or gradual. In some positions it is possible to account for these layers by referring them to changes in the condition of the surface-waters, but in other situations it seems necessary to call in elevations and subsidences of the sea-floor.

If the whole of the carbonate of lime shells be removed by dilute acid from a typical sample of Globigerina Ooze, the inorganic residue left behind is quite similar in composition to a typical Red Clay. This suggests that possibly, owing to some hypogene action, such as the escape of carbonic acid through the sea-floor, a deposit that once was a Globigerina Ooze might be slowly converted into a Red Clay. However, this is not the interpretation which commends itself after an examination of all the data at present available; a consideration of the rate of accumulation probably affords a more correct interpretation. It appears certain that the Terrigenous Deposits accumulate much more rapidly than the Pelagic Deposits. Among the Pelagic Deposits the Pteropod and Globigerina Oozes of the tropical regions, being made up of the calcareous shells of a much larger number of tropical species, apparently accumulate at a greater rate than the Globigerina Oozes in extra-tropical areas. Diatom Ooze being composed of both calcareous and siliceous organisms has again a more rapid rate of deposition than Radiolarian Ooze. In Red Clay the minimum rate of accumulation takes place. The number of sharks' teeth, of earbones and other bones of Cetaceans, and of cosmic spherules, in a deposit may indeed be taken as a measure of the rate of deposition. These spherules, teeth, and bones are probably more abundant in the Red Clays, because few other substances there fall to the bottom to cover them up, and they thus form an appreciable part of the whole deposit. The volcanic materials in a Red Clay having, because of the slow accumulation, been for a long time exposed to the action of sea-water, have been profoundly altered. The massive manganese-iron nodules and zeolitic crystals present in the deposit are secondary products arising from the decomposition of these volcanic materials, just as the formation of glauconite, phosphatic, and calcareous and barytic nodules accompanies the decomposition of terrigenous rocks and minerals in deposits nearer continental shores. There is thus a striking difference between the average chemical and mineralogical composition of Terrigenous and Pelagic Deposits.

It would be extremely interesting to have a detailed examination of one of those deep holes where a typical Red Clay is present, and even to bore some depth into such a deposit if possible, for in these positions it is probable that not more than a few feet of deposit have accumulated since the close of the Tertiary period. One such area lies to the south-west of Australia, and its examination might possibly form part of the programme of the approaching Antarctic explorations.

Life on the Ocean Floor.

It has already been stated that plant-life is limited to the shallow waters, but fishes and members of all the invertebrate groups are distributed over the floor of the ocean at all depths. The majority of these deep-sea animals live by eating the mud, clay, or ooze, or by catching the minute particles of organic matter which fall from the surface. It is probably not far from the truth to say that three-fourths of the deposits now covering the floor of the ocean have passed through the alimentary canals of marine animals. These mud-eating species, many of which are of gigantic size when compared with their allies living in the shallow coastal waters, become in turn the prey of numerous rapacious animals armed with peculiar prehensile and tactile organs. Some fishes are blind, while others have very large eyes. Phosphorescent light plays a most important rôle in the deep sea, and is correlated with the prevailing red and brown colours of deep-sea organisms. Phosphorescent organs appear sometimes to act as a bull's-eye lantern to enable particles of food to be picked up, and at other times as a lure or a warning. All these peculiar adaptations indicate that the struggle for life may be not much less severe in the deep-sea than in the shallower waters of the ocean.

Many deep-sea animals present archaic characters; still the deep sea cannot be said to contain more remnants of faunas which flourished in remote geological periods than the shallow and fresh waters of the continents. Indeed, king-crabs, Lingulas, Trigonias, Port Jackson sharks, *Ceratodus*, *Lepidosiren*, and *Protopterus*, probably represent older faunas than anything to be found in the deep sea.

Sir Wyville Thomson was of opinion that, from the Silurian period to the present day, there had been as now a continuous deep ocean with a bottom temperature oscillating about the freezing-point of fresh water, and that there had always been an abyssal fauna. I incline to the view that in Palæozoic times the ocean-basins were not so deep as they are now, that the ocean then had throughout a nearly uniform high temperature, and that life was either absent or represented only by bacteria and other low forms in great depths, as is now the case in the Black Sea, where life is practically absent beyond 100 fathoms, and where the deeper waters are saturated with sulphuretted hydrogen. This is not, however, the place to enter on speculations concerning the origin of the deep-sea fauna, nor to dwell on what has been called "bipolarity" in the distribution of marine organisms.

Evolution of the Continental and Oceanic Areas.

I have now pointed out what appears to me to be some of the more general results arrived at in recent years regarding the present condition of the floor of the ocean. I may now be permitted to indicate the possible bearing of these results on opinions as to the origin of some fundamental geographical phenomena, for instance, on the evolution of the protruding continents and sunken ocean-basins. In dealing with

such a problem, much that is hypothetical must necessarily be introduced, but these speculations are based on ascertained scientific facts. The well-known American geologist, Dutton, says:—"It has been much the habit of geologists to attempt to explain the progressive elevation of plateaus and mountain platforms, and also the foldings of strata, by one and the same process. I hold the two processes to be distinct, and having no necessary relation to each other. There are plicated regions which are little or not at all elevated, and there are elevated regions which are not plicated." Speaking of great regional uplifts, he says further:—"What the real nature of the uplifting force may be is, to my mind, an entire mystery, but I think we may discern at least one of its attributes, and that is a gradual expansion or a diminution of density of the subterranean magmas. . . . We know of no cause which could either add to the mass or diminish the density, yet one of the two must surely have happened. . . . Hence I infer that the cause which elevates the land involves an expansion of the underlying magmas, and the cause which depresses it is a shrinkage of the magmas: the nature of the process is at present a complete mystery." I shall endeavour to show how the detailed study of marine deposits may help to solve the mystery here referred to by Dutton.

The surface of the globe has not always been as we now see it. When, in the past, the surface had a temperature of about 400° F., what is now the water of the ocean must have existed as water vapour in the atmosphere, which would thereby—as well as because of the presence of other substances—be increased in density and volume. Life, as we know it, could not then exist. Again, science foresees a time when low temperatures, like those produced by Professor Dewar at the Royal Institution, will prevail over the face of the earth. The hydrosphere and atmosphere will then have disappeared within the rocky crust, or the waters of the ocean will have become solid rock, and over their surface will roll an ocean of liquid air, about 40 feet in depth. Life, as we know it, unless it undergoes suitable secular modifications, will be extinct. Somewhere between these two indefinite points of time in the evolution of our planet it is our privilege to live, to investigate, and to speculate concerning the antecedent and future conditions of things.

When we regard our globe with the mind's eye, it appears at the present time to be formed of concentric spheres, very like, and still very unlike, the successive coats of an onion. Within is situated the vast nucleus or *centrosphere*; surrounding this is what may be called the *tektosphere*,[1] a shell of materials in a state bordering on fusion, upon which rests and creeps the *lithosphere*. Then follow *hydrosphere* and *atmosphere*, with the included *biosphere*.[2] To the interaction of these six geospheres, through energy derived from internal and external sources, may be referred all the existing superficial phenomena of the planet.

The vast interior of the planetary mass, although not under direct observation, is known, from the results of the astronomer and physicist, to have a mean density of 5·6, or twice that of ordinary surface rock.

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[1] τηκτός, molten. [2] βίος, life.

The substances brought within the reach of observation in veinstones, in lavas, and hypogene rocks—by the action of water as a solvent and sublimant—warrant the belief that the centrosphere is largely made up of metals and metalloids with imprisoned gases. It is admitted that the vast nucleus has a very high temperature, but so enormous is the pressure of the superincumbent crust, that the melting-point of the substances in the interior is believed to be raised to a higher value than the temperature there existing—the centrosphere in consequence remains solid, for it may be assumed that the melting-point of rock-forming materials is raised by increase of pressure. Astronomers from a study of precession and nutation have long been convinced that the centrosphere must be practically solid.

Recent seismological observations indicate the transmission of two types of waves through the earth—the condensational-rarefactional, and the purely distortional—and the study of these tremors supports the view that the centrosphere is not only solid but possesses great uniformity of structure. The seismological investigations of Professors Milne and Knott point also to a fairly abrupt boundary or transition surface, where the solid nucleus passes into the somewhat plastic magma on which the firm upper crust rests.

In this plastic layer or shell—named the *tektosphere*—the materials are most probably in a state of unstable equilibrium and bordering on fusion. Here, the loose-textured solids of the external crust are converted into the denser solids of the nucleus or into molten masses, at a critical point of temperature and pressure; deep-seated rocks may in consequence escape through fissures in the lithosphere. Within the lithosphere itself the temperature falls off so rapidly towards the surface as to be everywhere below the melting-point of any substance there under its particular pressure.

Now, as the solid centrosphere slowly contracted from loss of heat, the primitive lithosphere, in accommodating itself—through changes in the tektosphere—to the shrinking nucleus, would be buckled, warped, and thrown into ridges. That these movements are still going on is shown by the fact that the lithosphere is everywhere and at all times in a slight but measurable state of pulsation. The rigidity of the primitive rocky crust would permit of considerable deformations of the kind here indicated. Indeed, the compression of mountain chains has most probably been brought about in this manner, but the same cannot be said of the elevation of plateaus, of mountain platforms, and of continents.

From many lines of investigation it is concluded, as we have seen, that the centrosphere is homogeneous in structure. Direct observation, on the other hand, shows that the lithosphere is heterogeneous in composition. How has this heterogeneity been brought about? The original crust was almost certainly composed of complex and stable silicates, all the silicon dioxide being in combination with bases. Lord Kelvin has pointed out that, when the solid crust began to form, it would rapidly cool over its whole surface; the precipitation of water would accelerate this process, and there would soon be an approximation to present conditions. As time went on the plastic or critical layer—the tektosphere

—immediately beneath the crust would gradually sink deeper and deeper, while ruptures and re-adjustments would become less and less frequent than in earlier stages. With the first fall of rain the silicates of the crust would be attacked by water and carbon dioxide, which can at low temperatures displace silicon dioxide from its combinations. The silicates in consequence have been continuously robbed of a part, or the whole, of their bases. The silica thus set free goes ultimately to form quartz veins and quartz sand on or about the emerged land, while the bases leached out of the disintegrating rocks are carried out into the ocean and ocean-basins. A continuous disintegration and differentiation of materials of the lithosphere, accompanied by a sort of migration and selection among mineral substances is thus always in progress. Through the agency of life, carbonate of lime accumulates in one place; through the agency of winds, quartz sand is heaped up in another; through the agency of water, beds of clay, of oxides of iron and of manganese are spread out in other directions.

The contraction of the centrosphere supplies the force which folds and crumples the lithosphere. The combined effect of hydrosphere, atmosphere, and biosphere on the lithosphere gives direction and a determinate mode of action to that force. From the earliest geological times the most resistant dust of the continents has been strewn along the marginal belt of the sea-floor skirting the land. At the present time the deposits over this area contain on the average about 70 per cent. of free and combined silica, most of this being in the form of quartz sand. In the abysmal deposits far from land there is an average of only about 30 per cent of silica, and hardly any of this in the form of quartz sand. Lime, iron, and the other bases largely predominate in these abysmal regions. The continuous loading on the margins of the emerged land by deposits tends by increased pressure to keep the materials of the tektosphere in a solid condition immediately beneath the loaded area. The unloading of emerged land tends by relief of pressure to produce a viscous condition of the tektosphere immediately beneath the denuded surfaces. Under the influence of the continuous shakings, tremors, and tremblings always taking place in the lithosphere the materials of the tektosphere yield to the stresses acting on them, and the deep-seated portions of the terrigenous deposits are slowly carried towards, over, or underneath the emerged land. The rocks subsequently re-formed beneath continental areas out of these terrigenous materials, under great pressure and in hydrothermal conditions, would be more acid than the rocks from which they were originally derived, and it is well known that acid rocks have a less specific gravity than intermediate or basic ones. By a continual repetition of this process the continental protuberances have been gradually built up of lighter materials than the other parts of the lithosphere. The relatively light quartz, which is also the most refractory, the most stable, and the least fusible among rock-forming minerals, plays in all this the principal rôle. The average height of the surface of the continents is about three miles above the average level of the abysmal regions. If now we assume the average density of the crust beneath the continents to be 2·5, and of the part beneath the abysmal regions to be 3,

then the spheroidal surface of equal pressure—the tektosphere—would have a minimum depth of eighteen miles beneath the continents and fifteen miles beneath the oceans, or, if we assume the density of the crust beneath the continents to be 2·5 and beneath the abysmal regions to be 2·8, then the tektosphere would be twenty-eight miles beneath the continents and twenty-five miles beneath the oceans. The present condition of the earth's crust might be brought about by the disintegration of a quantity of quartz-free volcanic rock, covering the continental areas to a depth of eighteen miles, and the re-formation of rocks out of the disintegrated materials.

Where the lighter and more bulky substances have accumulated there has been a relative increase of volume, and in consequence bulging has taken place at the surface over the continental areas. Where the denser materials have been laid down there has been flattening, and in consequence a depression of the abysmal regions of the ocean-basins. It is known that, as a general rule, where large masses of sediment have been deposited, their deposition has been accompanied by a depression of the area. On the other hand, where broad mountain platforms have been subjected to extensive erosion, the loss of altitude by denudation has been made good by a rise of the platform. This points to a movement of matter on to the continental areas.

If this be anything like a true conception of the interactions that are taking place between the various geospheres of which our globe is made up, then we can understand why, in the gradual evolution of the surface features, the average level of the continental plains now stands permanently about three miles above the average level of those plains which form the floor of the deep ocean-basins. We may also understand how the defect of mass under the continents and an excess of mass under the oceans have been brought about, as well as deficiency of mass under mountains and excess of mass under plains. Even the local anomalies indicated by the plumb-line, gravity, and magnetic observations may in this way receive a rational explanation. It has been urged that an enormous time—greater even than what is demanded by Darwin—would be necessary for an evolution of the existing surface features on these lines. I do not think so. Indeed, in all that relates to geological time I agree, generally speaking, with the physicists rather than with the biologists and geologists.

Progress of Oceanic Research.

I have now touched on some of the problems and speculations suggested by recent deep-sea explorations, and there are many others, equally attractive, to which no reference has been made. It is abundantly evident that, for the satisfactory explanation of many marine phenomena, further observations and explorations are necessary. Happily there is no sign that the interest in oceanographical work has in any way slackened. On the contrary, the number of scientific men and ships engaged in the study of the ocean is rapidly increasing. Among all civilised peoples and in all quarters of the globe the economic

importance of many of the problems that await solution is clearly recognised.

We have every reason to be proud of the work continually carried on by the officers and ships attached to the Hydrographic Department of the British Navy. They have surveyed coasts in all parts of the world for the purposes of navigation, and within the past few years have greatly enlarged our knowledge of the sea-bed and deeper waters over wide stretches of the Pacific and other oceans. The samples of the bottom which are procured, being always carefully preserved by the officers, have enabled very definite notions to be formed as to the geographical and bathymetrical distribution of marine deposits.

The ships belonging to the various British Telegraph Cable Companies have done most excellent work in this as well as in other directions. Even during the present year, Mr. R. E. Peake has in the s.s. *Britannia* procured 477 deep soundings in the North Atlantic, besides a large collection of deep-sea deposits, and many deep-sea temperature and current observations.

The French have been extending the valuable work of the *Talisman* and *Travailleur*, while the Prince of Monaco is at the present moment carrying on his oceanic investigations in the Arctic Seas with a large new yacht elaborately and specially fitted out for such work. The Russians have recently been engaged in the scientific exploration of the Black Sea and the Caspian Sea, and a special ship is now employed in the investigation of the Arctic fisheries of the Murman coast under the direction of Professor Knipowitsch. Admiral Makaroff has this summer been hammering his way through Arctic ice, and at the same time carrying on a great variety of systematic observations and experiments on board the *Yermak*—the most powerful and most effective instrument of marine research ever constructed. Mr. Alexander Agassiz has this year recommenced his deep-sea explorations in the Pacific on board the U.S. steamer *Albatross*. He proposes to cross the Pacific in several directions, and to conduct investigations among the Paumotu and other coral island groups. Professor Weber is similarly employed on board a Dutch man-of-war in the East Indian Seas. The Deutsche Seewarte at Hamburg, under the direction of Dr. Neumayer, continues its praiseworthy assistance and encouragement to all investigators of the ocean, and this year the important German Deep-sea Expedition, in the s.s. *Valdivia*, arrived home after most successful oceanographical explorations in the Atlantic, Indian, and Great Southern Oceans.

The *Belgica* has returned to Europe safely with a wealth of geological and biological collections and physical observations, after spending, for the first time on record, a whole winter among the icefields and icebergs of the Antarctic. Mr. Borchgrevink in December last again penetrated to Cape Adare, successfully landed his party at that point, and is now wintering on the Antarctic continent. The expeditions of Lieutenant Peary, of Professor Nathorst, of Captain Sverdrup, and of the Duke of Abruzzi, which are now in progress, may be expected to yield much new information about the condition of the Arctic Ocean. Mr. Wellman

has just returned from the north of Franz Josef Land with observations of considerable interest.

Some of the scientific results obtained by the expeditions in the Danish steamer *Ingolf* have lately been published, and these, along with the results of the joint work pursued for many years by the Swedes, Danes, and Norwegians, may ultimately have great economic value from their direct bearing on Fishery problems, and on weather forecasting over long periods of time.

Largely through the influence of Professor Otto Pettersson an International Conference assembled at Stockholm a few months ago, for the purpose of deliberating as to a programme of conjoint scientific work in the North Sea and northern parts of the Atlantic, with special reference to the economic aspect of sea-fisheries. A programme was successfully drawn up, and an organisation suggested for carrying it into effect; these proposals are now under the consideration of the several states. The Norwegian Government has voted a large sum of money for building a special vessel to conduct marine investigations of the nature recommended by this conference. It is to be hoped the other North Sea Powers may soon follow this excellent example.

The various marine stations and laboratories for scientific research in all parts of the world furnish each year much new knowledge concerning the ocean. Among our own people the excellent work carried on by the Marine Biological Association, the Irish Fisheries Department, the Scottish Fishery Board, the Lancashire Fisheries Committee, the Cape and Canadian Fisheries Departments, is well worthy of recognition and continued support. Mr. George Murray, Mr. H. N. Dickson, Professor Cleve, Professor Otto Pettersson, Mr. Robert Irvine, and others, have, with the assistance of the officers of the Mercantile Marine, accumulated in recent years a vast amount of information regarding the distribution of temperature and salinity, as well as of the planktonic organisms at the surface of the ocean. The papers by Mr. H. C. Russell on the icebergs and currents of the Great Southern Ocean, and of Mr. F. W. Walker on the density of the water in the Southern Hemisphere, show that the Australian colonies are taking a practical interest in oceanographical problems.

Proposed Antarctic Explorations.

The great event of the year, from a geographical point of view, is the progress that has been made towards the realisation of a scheme for the thorough scientific exploration in the near future of the whole South Polar region. The British and German Governments have voted or guaranteed large sums of money to assist in promoting this object, and princely donations have likewise been received from private individuals—in this connection the action of Mr. L. W. Longstaff in making a gift of £25,000, and of Mr. A. C. Harmsworth in promising £5000, being beyond all praise.

There is an earnest desire among the scientific men of Britain and Germany that there should be some sort of co-operation with regard to

the scientific work of the two expeditions, and that these should both sail in 1901, so that the invaluable gain attaching to simultaneous observations may be secured. Beyond this nothing has, as yet, been definitely settled. The members of the Association will presently have an opportunity of expressing their opinions as to what should be attempted by the British Expedition, how the work in connection with it should be arranged, and how the various researches in view can best be carried to a successful issue.

I have long taken a deep interest in Antarctic exploration, because such exploration must necessarily deal largely with oceanographical problems, and also because I have had the privilege of studying the conditions of the ocean within both the Arctic and Antarctic circles. In the year 1886 I published an article on the subject of Antarctic Exploration in the *Scottish Geographical Magazine*. This article led to an interesting interview, especially when viewed in the light of after-events, for, a few weeks after it appeared in type, a young Norwegian walked into the *Challenger* Office in Edinburgh to ask when the proposed expedition would probably start, and if there were any chance of his services being accepted. His name was Nansen.

When at the request of the President I addressed the Royal Geographical Society on the same subject in the year 1893, I made the following statement as to what it seemed to me should be the general character of the proposed exploration: "A dash at the South Pole is not, however, what I advocate, nor do I believe *that* is what British Science at the present time desires. It demands rather a steady, continuous, laborious, and systematic exploration of the whole southern region with all the appliances of the modern investigator." At the same time I urged further, that these explorations should be undertaken by the Royal Navy in two ships, and that the work should extend over two winters and three summers.

This scheme must now be abandoned, so far at least as the Royal Navy is concerned, for the Government has intimated that it can spare neither ships nor officers, men nor money, for an undertaking of such magnitude. The example of Foreign Powers—rather than the representations from our own scientific men—appears to have been chiefly instrumental in at last inducing the Government to promise a sum of £45,000, provided that an equal amount be forthcoming from other sources. This resolve throws the responsibility for the financial administration, for the equipment, and for the management of this exploration, on the representative scientific societies, which have no organisation ready for carrying out important executive work on such an extensive scale. I am doubtful whether this state of matters should be regarded as a sign of increasing lukewarmness on the part of the Government towards marine research, or should rather be looked on as a most unexpected and welcome recognition of the growing importance of science and scientific men to the affairs of the nation. Let us adopt the latter view, and accept the heavy responsibility attached thereto.

Any one who will take the trouble to read, in the *Proceedings* of the Royal Society of London, the account of the discussion which recently

took place on "The Scientific Advantages of an Antarctic Expedition," will gather some idea of the number and wide range of the subjects which it is urged should be investigated within the Antarctic area; the proposed researches have to do with almost every branch of science. Unless an earnest attempt be made to approach very near to the ideal there sketched out, widespread and lasting disappointment will certainly be felt among the scientific men of this country. The proposed expedition should not be one of adventure. Not a rapid invasion and a sudden retreat, with tales of hardships and risks, but a scientific occupation of the unknown area by observation and experiment should be aimed at in these days.

I have all along estimated the cost of a well-equipped Antarctic Expedition at about £150,000. I see no reason for changing my views on this point at the present time, nor on the general scope of the work to be undertaken by the proposed expedition, as set forth in the papers I have published on the subject. There is now a sum of at most £90,000 in hand, or in view. If one ship should be specially built for penetrating the icy region, and be sent south with one naturalist on board, then such an expedition may, it will be granted, bring back interesting and important results. But it must be distinctly understood that this is not the kind of exploration scientific men have been urging on the British public for the past fifteen or twenty years. We must, if possible, have two ships, with landing parties for stations on shore and with a recognised scientific leader and staff on board of each ship. Although we cannot have the Royal Navy, these ships can be most efficiently officered and manned from the Mercantile Marine. With only one ship many of the proposed observations would have to be cut out of the programme. In anticipation of this being the case, there are at the present moment irreconcilable differences of opinion, among those most interested in these explorations, as to which sciences must be sacrificed.

The difficulties which at present surround this undertaking are fundamentally those of money. These difficulties would at once disappear, and others would certainly be overcome, should the members of the British Association at this meeting agree to place in the hands of their President a sum of £50,000, so that the total amount available for Antarctic exploration would become something like £150,000. Although there is but one central Government, surely there are within the bounds of this great empire two more men like Mr. Longstaff. The Government has suddenly placed the burden of upholding the high traditions of Great Britain in marine research and exploration on the shoulders of her scientific men. In their name I appeal to all our well-to-do fellow-countrymen in every walk of life for assistance, so that these new duties may be discharged in a manner worthy of the empire and of the well-earned reputation of British Science.

ASCENT OF THE BIAFO GLACIER AND HISPAR PASS: TWO PIONEER ASCENTS IN THE KARAKORAM.

By Fanny Bullock Workman, F.R.S.G.S., and Corr. Member of the National Geographic Society of Washington.

A few notes from a distant Fellow about a very interesting trip in Baltistan and Braldu may not be unacceptable to the *Magazine*. Our party consisted of Dr. W. H. Workman, the writer of this paper, the Swiss guide, M. Zurbriggen, and about fifty coolies. We left Srinagar, Kashmir, on July 1st, and passed by the upper Deosai route to Skardu and Shigar. From there we marched to Askar nullah, followed up the nullah in two marches, and, on a third, crossed the Skoro La pass, 17,000 feet, to Askole at the foot of the Biafo and Baltoro glaciers. We were told, both in Skardu and Shigar, that we could not cross this high route so early in the season; but we did so, and without especial difficulty.

This pass, little known, is one of the most beautiful of the eighteen high passes we have crossed in the Himalayas during the past two seasons. From the gradually ascending nullah (ravine), one reaches the base of the pass at about 13,000 feet. From here one ascends a very sharp, at first grassy, then rocky, arête of from 3500 to 4000 feet, to the foot of a sharp scree wall. Hence one must pick one's way as best one can, over loose rocks and slabs to the col. There is no snow, with the exception of a patch or two of névé on the south side. On the north, within twenty feet of the top, you are on snow, and the descent is made at first over a snow slope of perhaps 800 feet, followed by the long Skoro La glacier and moraine, and by long rock and grass slopes leading to the Askole valley, 10,200 feet. The Skoro La is a passage between a grand circle of snowy peaks, varying, as well as one can judge, from eighteen to twenty-two thousand feet in height. From them, four beautiful glaciers, three of them greatly broken up into séracs, sweep downward to the upper valley. The peaks of the range strongly resemble, on a gigantic scale, those seen from the Gorner Grat, viz., Monte Rosa, Lyskamm, Castor and Pollux, etc.

Before Askole we crossed, without much strain upon our nerves, the long rope bridge, so graphically described by Sir W. Martin Conway, which spans the 250-foot wide Braldu river. Leaving Askole, we spent eighteen days on the Biafo glacier, following it up to the Hispar pass, and came back to Askole. Sir W. M. Conway and party were the first Europeans to cross it from Hunza. Our visit is the only complete one recorded since. Zurbriggen, who accompanied Mr. Conway in 1891, reports the glacier as having greatly receded, and as much more broken up and difficult to pass in the lower part than formerly. We certainly had trouble enough in getting our coolie train over the first three days' work. One day was lost in cutting steps up and down and around huge séracs, running to eighty feet in height, and in walking round wide

bridgeless crevasses, that often extended a mile or more across the glacier. After two hours had been spent in effecting a passage of a difficult gallery between two high séracs, we found ourselves cut off by an immense impassable crevasse. As it was considerably past midday it was decided that we should return to camp above the moraine, and allow Zurbriggen to go on a reconnaissance trip the day after. He found a passage a trifle less impracticable, and piloted us and our fifty men through safely.

As we advanced, keeping to the middle of the huge ice-river, these obstacles became less, our greatest difficulty being to reach camps on the sides at night. This required from one to two hours' scrambling over moraine-covered séracs, and was laborious work. We were detained several days at "Boggy" and "Ogre" camps by snowstorms, but were much favoured from the latter camp and across Snow lake to Hispar pass and back by cloudless weather, and perfect views of the world of icy peaks and immense snowfields. We roped in crossing Snow lake, which extends from the upper Biafo to the base of the Hispar pass, and beyond to the foot of a circle of high peaks. The coolies followed our spoor unroped, but it was a long and tiresome passage, crevasses being numerous and generally covered by fresh snow.

Our highest camp on this journey was on an ice-ledge at the top of a snow-slope above Snow lake, height 16,400 feet, temperature 21° F. at night. The opening out of the Biafo into Snow lake is a unique and particular feature of this region. It is literally a huge lake of snow, girdled by lines of very high unnamed snowy peaks. Its diameter is hard to estimate. We crossed more than two-thirds its length to the north in going to the Hispar pass, and this occupied about two and a half hours' slow walking. The ascent to the pass is over a long snowy slope, slightly crevassed. The summit is also, in a certain sense, a second snow lake, long and broad, bordered on the sides by high peaks. Descending to the west, the pass ceases where the crevasses of the Hispar glacier begin. The height of the pass is given by Mr. Conway as 17,600 feet; our Watkin aneroid measured 17,475 feet.

We passed two nights in Ice camp, and on the second morning descended over Snow lake in a snow-squall to Ogre camp. This bivouac was also left in a hard snowstorm the following day. Before we had been one hour on the glacier, the snow reached a depth of four inches. We realised, for the first time, the dangerous conditions offered by the great glacier in a storm. The deep snow covering many of the crevasses and the dense atmosphere rendered progress slower and slower. Fortunately, after two or three hours, we found a line of moraine, which we were able to follow down until the storm abated, about noon. A band of natives coming from Nagyr were lost here in bad weather about thirty years ago, and, after experiencing a snowstorm on the Biafo, one understands how such a catastrophe might occur, under certain circumstances. Although we had much bad weather, and were frequently stormed into camp, we took advantage of every fine day, and the good days were usually absolutely clear in July, and thus we saw all the peaks and glaciers on both sides of the Biafo at one time or another.

From the point of view of scenery it is one of the most interesting and beautiful spots in the Himalayas. The grandeur and variety of fantastic shapes displayed in the massives and single peaks on the left bank offer an ever-changing panorama that knows no monotony. On the right, narrow glacial valleys often open, leading to great snowy peaks, from twenty-one to twenty-six thousand feet in height. From these most interesting glaciers descend to meet the parent glacier.

As regards the men necessary for an expedition in these icy regions, our difficulty was not in procuring them, but in making some of them return as our loads grew lighter, as had been agreed, and in making the others go on. The Askole coolies are not a brave lot; and several altercations, in which Zurbriggen's nailed boot played a part, took place before our progress above wooded camps was effected. When once on snow and ice they stand rarefied air at sixteen and eighteen thousand feet better than do the general average of Shigar and Kashmir coolies.

On the 5th of August we left Askole on the return trip, ascended the nullah, crossed the Skoro La glacier, and encamped on a moraine at 16,000 feet, at the base of the glaciers and peaks of the unknown, untrodden circle of snow summits to the east of the pass. Our object was to ascend, if possible, one or more of these summits. We decided to try first the one adjoining and overhanging the pass to the east.

We left our high camp at 5 A.M., made the crossing of a much broken-up glacier in three and a half hours, followed up an ascending snow plateau, and then began the ascent of a snow arête of the main mountain. I must here speak of the exploring mountaineer qualities of Zurbriggen. I have on several occasions noticed his especial ability to select what he calls a "gute Strasse." On this one, a guide less accustomed to attacking new ground might have wasted several hours in finding the proper way through the endless great séracs and crevasses; as it was, our advance was constant, although there was no previous inspection of the glacier. From the snow arête we had a long, loose, shale rock slope, then another long rock and snow arête to the summit, which rises in the form of a beautiful white horn.

Two Askole porters accompanied us, getting on very well, where steps were cut, in nailed boots loaned by the Kashmiri servants. They put up their hands in the usual prayer attitude on the last thousand feet, pointed to their heads, and begged to remain behind; but, as no attention was paid to their pleadings, they went on well enough to the top, and there lay down and slept until aroused to build a cairn. We were five and a half hours from our camp in making the ascent. The view toward the Biafo ice-kings and Hunza is very grand. To the west Nanga Parbat overtops every lower hill in a golden massive of unearthly glory. To the east Masherbrum reared its 26,000-foot white walls, while K2 and Gusherbrum were cut off by intervening peaks. The height, taken from the average registered by two aneroids of late construction, 18,600 feet, was judged to be approximately correct when compared with the officially measured height of the pass below, 17,000 feet. We named the peak the Siegfried Horn. A cairn was built on the rock

summit, 30 feet below the snowy one, in which was placed a jar containing the names of the climbers, and the height and name of the peak.

Three days later from an upper ice camp at 17,400 feet we ascended the sixth snowy summit of the range. After a short bit of moraine and glacier the main ascent began, and continued over rather steep snow and ice slopes to the last slope, 300 feet high, which rose at an angle of fully sixty degrees. This, at a height of over 19,000 feet, made us move somewhat slowly, particularly hampered as we were by the hobnail-booted coolies, who from the lower end of the rope were, as before, begging to be left behind. I have made more difficult ascents in the Alps, but never a more interesting one.

We both felt quite fit at the summit, experiencing no ill effects from the rarefied air beyond mild headaches and at once losing breath upon sudden exertion. Of Zurbriggen I will not speak, as rarefied air does not affect his breathing below 21,000 feet. The height was taken in the same manner as on the first peak. The comparison made with the height of the pass, which from here lay fully 2500 feet below, together with the registering of the aneroids, left little doubt in the mind of Zurbriggen that we were not overestimating the peak at 19,450 feet. We named it Mount Bullock Workman, and buried our bottled cards in the snow, where doubtless they will, alas, never be found.

The view was the grandest I have seen from a high summit. Unexplored Karakoram giants marshalled their forces in long white lines to the north; from our peak we looked down upon a new, immense, unexplored glacier; beyond this, over lesser summits, towered the great rock and snow battlements and slopes of Mt. Godwin-Austen. To the left Gusherbrum lifted its head, and far to the right the glorious double-pronged peaks of the Golden Throne pierced the blue sky with amber points, and, as from the Siegfried Horn, Nanga Parbat floated like a god over a sea of supporting peaks on the horizon toward Kashmir.

THE BRITISH ASSOCIATION AT DOVER, 1899.

THE sixty-ninth annual meeting took place at Dover under the presidency of Sir Michael Foster, K.C.B., who delivered his address on the 13th September. At the meeting of the general committee, held previously, it was agreed to contribute to the National Antarctic Expedition a sum of £1000 out of the accumulated funds of the Association; and it was announced that satisfactory arrangements had been made by the Government for the establishment of an ethnographical bureau for Greater Britain in connection with the British Museum. It was further agreed to ask the Government to place at the disposal of the Seismological Committee of the Association a building suitable for the accommodation of apparatus for continuous observations of movements of the Earth's crust.

On the morning of the 14th September, Sir John Murray, K.C.B.,

the President of the Geographical Section, delivered his address, which is printed in this number of the *Magazine*. His remarks were illustrated by charts of marine deposits and of ocean depths, as well as by numerous lantern slides. A vote of thanks was moved by Colonel Church, the retiring president of the Section, and Sir Michael Foster strongly supported Sir John's plea for additional funds to efficiently equip the Antarctic expedition.

In the afternoon Dr. Mill read the report of the Committee on African Climatology. This was followed by an extremely interesting account by Admiral Makaroff, Russian navy, of an Arctic voyage in the ice-breaker *Yermak*. He described his voyage as the trial trip of an ice-ship. He always found it possible to deal with Polar ice, which has a tendency to crack, and, even when 14 feet in thickness, readily yields to the charge of the ship. Thick ice is indeed of weaker structure than that which is comparatively thin. The paper was illustrated by a well-executed series of lantern slides showing the *Yermak* breaking her way through the ice. Sir John Murray, who testified to the great value of the oceanographical work done by the admiral, thought that a vessel of the kind described would be of great value to a Polar expedition, but observed that, being constructed of iron, it could not be used for magnetic observations.

The day's proceedings closed with an account by Mr. W. S. Bruce of the physical observations made in the Barents Sea during his recent voyages in the *Windward* and *Blencathra*. He gave some interesting details regarding the temperature, salinity, and colour of the sea-water, and briefly summed up the results.

On Friday the 15th the proceedings were opened by Dr. Mill, who read "Notes on the Voyage of the *Southern Cross* from Hobart to Cape Adare," and showed a number of views taken during its course. He explained that the narrative aimed at giving information regarding the observed conditions of the ice and of the atmosphere, such as might be useful to explorers starting before the return of the *Southern Cross*. Mr. Borchgrevink, who commands the expedition and the ship, aided by a sailing-master, reached Cape Adare on 17th February, and remained there with a party of ten men and five dogs who were to travel southwards over the ice. News of them may be expected in about February or March of next year.

Dr. H. Arctowski, a member of the scientific staff of the *Belgica* expedition, speaking in French, gave an account of the voyage of that vessel to the Antarctic. He displayed a chart, and illustrated his remarks by numerous lantern slides. He then read, in English, his paper, on "The Problem of Antarctic Exploration," in which he expressed his opinion that Antarctic explorations must be conducted in three ways:—

1. A system of fixed stations arranged between the edge of the continent and the zone of ice. These stations should be supplied with all necessary magnetic and meteorological instruments, and continue at work simultaneously for one year at least.

2. During the same year two polar expeditions should set out on opposite sides

towards the South Pole. This would involve two vessels strong enough to withstand the pack and equipped for wintering.

3. Finally a circumpolar expedition, planned to follow the edge of the pack right round, and specially equipped for oceanographical and zoological work. This expedition would also survey the accessible parts of the Antarctic coast.

Such a system of exploration must necessarily be the work of several nations. Weyprecht's idea should be revived and followed. Antarctic exploration must be conducted systematically, and it ought to be international. A series of circumpolar stations, where comparable and simultaneous observations could be carried on, would make the results of the British and German Antarctic expeditions remarkably complete, and vastly enhance their value.

I should suggest the following arrangement of stations.

A polygon of stations should unite South America and the Antarctic lands. The path of the cyclonic storms passes to the south of Cape Horn, and—at least during part of the year—to the north of Palmer Land. The polygon should include stations on the east and west coasts of Graham Land, and one of the South Shetland Islands, on South Orkney and on one of the Sandwich Islands, together with stations at Cape Pillar, Cape de las Virgenes, Cape Horn, Staten Island and the Falklands. With such a system no cyclone of any importance could escape detection. These cyclones seem to travel in the general direction of the upper winds from west to east, and they seem to follow the outline of Alexander, Graham, and Palmer Lands, but how and why this is so we cannot tell as yet. Between South America and the Antarctic land there is a belt of low pressure which seems to encircle the Antarctic region where there is apparently a permanent anticyclone; but observations are wanting to determine the associated conditions of atmospheric circulation.

It seems scarcely necessary to insist on the advantages which two other polygons of stations would present, one to the south of the Indian Ocean, the other between New Zealand and Victoria Land. The second polygon would be formed by the islands of Prince Edward, Crozet, Kerguelen, and a station on Enderby Land. The third polygon would include the Balleny, Macquarie, and Auckland Islands. This would be a particularly interesting polygon on account of its comparative proximity to the magnetic pole.

The two vessels designed to winter in the pack should approach along the meridians of 145° W. and 35° E. Imprisoned in the pack, as the *Belgica* was, these vessels would be able to carry on oceanographical and zoological work, and also to collect magnetic and meteorological observations, thus adding two stations near the Pole to the various polygons. From the meteorological point of view it would be extremely interesting for these vessels to reach high latitudes, for the region near the Pole will probably differ greatly from the northern edge of the Antarctic lands in everything regarding atmospheric pressure, wind and storms.

As to the circumpolar expeditions I think that the vessel intended for this purpose should be quite independent of those which penetrate the pack. The region is too great to admit of the whole voyage being completed in one season—three would probably be necessary. It is not easy to indicate the route which should be followed, for everything depends on circumstances. Still it may be observed, that—in summer at least—easterly winds predominate near the edge of the south polar pack, and therefore it would be advantageous to proceed from east to west.

Leaving the river Plate in September the vessel might commence work at the South Shetlands at the beginning of October. The months from November to

March might be occupied in the voyage from 60° W. to 150° W. along the pack, and thence a passage might be made to Melbourne. The following summer the extreme south of the Indian Ocean might occupy the vessel, and a third season might be devoted to the Antarctic Atlantic.

This programme is doubtless but a dream. I often wished, on board the *Belgica*, that I dared to propose it as a programme, because it seemed to me perfectly realisable. One may perhaps speak of it at the dawn of a new century.

The third paper on the programme was one by Mr. J. G. Buchanan, F.R.S., on "The Work of an Antarctic Expedition." In conclusion he remarked:—

With regard to the district which would fall to the English expedition to explore, I should welcome an arrangement which would enable it to follow to its Antarctic source the remarkable stream of very cold water which the *Challenger* found flowing at the bottom of the depression which runs along the eastern coast of South America from the river Plate to the Equator. This work would also carry the expedition in the direction of Weddell's highest latitude, and of Ross's deepest sounding. The base of the English expedition would then be the Falkland Islands.

Mr. George Murray then urged the importance of a botanical exploration of the Antarctic. He exhibited apparatus used for collecting specimens in sea water, and lantern slides showing the nature of the minute vegetable organisms found therein.

After the reading of these four papers the President invited discussion on the subject of Antarctic exploration. This was opened by Professor Rücker, who said—

That the Royal Society was extremely anxious that an Antarctic expedition should be carried out, and was working hand-in-hand with the Geographical Society with that object. He would not go into a detailed account of what was desirable from the magnetic point of view, but he would say that what was desired was not so much that there should be one or two fixed stations for observation as that a reasonably accurate survey should be carried out of the whole of the Antarctic regions. If a series of observations round the Pole could be obtained, that would be one of the most valuable forms of magnetic observation. Of course, however, magneticians would be glad to see a series of well-distributed stations. A well-distributed series of stations was more important than that those stations should be in a very far south latitude. In an expedition of this sort they must be content with a compromise between what was desirable and what was possible, though, no doubt, different advantages were to be obtained from the two different methods of carrying out an expedition, and it would be better to have both.

Admiral Makaroff urged the importance of providing strong ships which could master the ice.

The discussion was continued by Major Darwin, Dr. Koettlitz, and others, when it was wound up by the President, who urged that, if possible, the expedition should be composed of two ships, one being a small ship for magnetic observation and ice penetration as far as possible south, and another for sounding the regions and making biological and physical observations. That would be the ideal, but it could not be reached unless £50,000 or £60,000 was obtained from the public.

In the afternoon, Dr. H. O. Forbes read the report of the committee on "The Exploration of Socotra," and showed a most interesting series of photographic slides depicting the scenery and vegetation of the island, together with its inhabitants and the buildings, ancient and modern, found on it. He found elements of the fauna and flora of Madagascar, Eastern Africa, South America and Australia, which seem to indicate a former land-connection between these now widely separated regions.

Mrs. W. Rickmer Rickmers followed with an account of her travels in East Bokhara.

Accompanied by Mr. Rickmers and Dr. v. Krafft, I left the ancient capital of Bokhara in June 1898. The object of the journey was the exploration of some of the little-known parts of the eastern provinces of the Khanate. After a two-weeks' ride on horseback through steppe and loess, the mountains of the province of Baljuan were reached.

We lived for five months among the conglomerate mountains of the Yakh-su valley. This region is extremely wild and fantastic, reminding one at the same time of the Dolomites and the "Bad Lands," with their dark and deep cañons. The natives, who speak a Persian dialect, extract gold from the alluvial deposits in these valleys. Their method is very primitive, and yields them a precarious livelihood but experiments conducted on a large scale have shown that modern processes must assure big profits to enterprising pioneers. The stones composing the conglomerate are mostly crystalline, and the whole formation, which is in places 4000 ft. thick, is ascribed by Dr. v. Krafft to the Tertiary period. The highest summit, a towering cupola, is 13,000 ft. high, and was several times climbed. A glacier of the second order comes down on one side, and is curious for having a moraine composed of rounded fragments, which, of course, could not be otherwise seeing that the mountain is entirely composed of conglomerate. Mr. Rickmers and Dr. v. Krafft, after several attempts, succeeded in making the first ascent of the Kuch-Manar, a jagged peak 12,000 ft. in height. The views obtained from these points were most beautiful and instructive; towards the east one beheld an ocean of snow and ice, bounded by the Pamir and the Alai, whereas towards the west the ground sloped down to the immense Transcaspian plain.

Much time was devoted to the examination of phenomena new to the literature of physical geography. These were the "Barriers of the Dandushka," which are remarkable for having been formed by hydrodynamic agencies, and for having subsequently been pierced by a cañon, likewise formed by water. Vegetable and animal life were not abundant. Thin woods are only to be found in some of the more secluded valleys, where the natives rarely penetrate.

Excursions into the surrounding provinces were also made. Dr. v. Krafft visited Darwaz, and brought back valuable geological information. Mr. Rickmers and I went to Kulab, and thence to the Afghan frontier, where we spent several days among the jungles of the Oxus.

The return journey was *viâ* Baljuan, Karatagh, Baissnu, and Kitab to Samarkand. From Samarkand an interesting lake, the Timur-Dera-kul, situated at a great height among the mountains, was visited.

The day's work of the Section was brought to a close by the reading of a paper by Mr. O. H. Howarth on his recent journey in Western Oaxaca, Mexico. This paper will appear in the *Magazine*.

The first paper read on Saturday was one by Dr. Schott, describing

the oceanographical and meteorological results of the German Deep-Sea Expedition in the s.s. *Valdivia*. He exhibited a chart of the voyage, which was made in an iron vessel of 1400 tons, with a single screw. He discussed the soundings for depth, the chemical analysis and temperature of the water, with a description of the thermometers used, and the condition of the ice encountered in high southern latitudes. Meteorological observations were recorded at intervals of four hours, day and night, throughout the entire voyage. A series of excellent photographic slides showed the apparatus employed, the various forms of icebergs encountered, and other objects. After the reading of his paper, a discussion, in which Mr. Buchanan, Mr. H. N. Dickson, and Admiral Makaroff took part, was raised as to the most suitable forms of thermometer and hydrometer for ocean work, and the President then congratulated the German nation on the success of their first Deep-Sea Expedition.

Mr. H. N. Dickson followed with a paper on "The Mean Temperature of the Surface Waters of the Sea round the British Coasts, and its Relation to that of the Air." The following is an abstract:—

The mean monthly and annual temperatures of the surface waters of the sea during the period 1880-97 are shown for sixty-five stations distributed round the coasts of England, Scotland, and Ireland. The average for the year at the entrance to the English Channel is nearly 54° F.; it falls as the Channel narrows to 52° between the Start and Cape la Hague, and remains steady to beyond the Straits of Dover, at least as far as the East Goodwin light vessel. On the south-west coast of Ireland the annual mean is about 52°, falling to 51° in St. George's Channel, and 50° in the Irish Sea. A slow fall from 52° to 50° takes place on the west coast of Ireland until the north-west corner is reached. The mean of 49° persists along the north coast of Ireland to the North Channel, and along the whole of the west coast of Scotland to Stornoway. On the east coast temperature falls very quickly, as soon as we get out of range of the Straits of Dover, to 50° off Suffolk and Norfolk, and then there is a gradual fall as we go northwards, to 48° off the coast of Northumberland, 47½° off Aberdeenshire, and 47° at the Orkneys and Shetlands. The effect of the tidal streams in mixing the waters is exceedingly well marked. The annual minimum of temperature rarely occurs in March, most frequently in January, especially at stations open to the Atlantic. The annual maximum occurs almost everywhere in August.

Mean temperatures of the surface water are compared with the forty-year averages for the air, recently published by Buchan. A comparison shows that the mean annual difference has hitherto been somewhat overestimated, especially on the western coast; in no case is the mean excess of sea over air temperature greater than 2° F. The maximum difference occurs everywhere in November and December, and is greatest on the south coast of England between Portland Bill and the Straits of Dover.

The Section then adjourned for the day.

The first paper on Monday the 18th was one by Sir John Murray and Mr. F. P. Pullar on "The Bathymetrical Survey of the Scottish Fresh-Water Lochs"—a work of great importance, which, as the Government could not be induced to take it up, is being carried out by them personally, at their own expense. The results will be published in the

Magazine. Mr. Pullar exhibited the sounding apparatus employed, which was constructed after his own design.

This was followed by a paper by Sir John Murray and Mr. Robert Irvine on "The Distribution of Nitrogen and Ammonia in Ocean Water." Mr. H. N. Dickson then dealt with "The Temperature and Salinity of the Surface Water of the Atlantic during 1896 and 1897."

The completed series of forty-eight monthly charts of surface temperature and salinity, the mode of construction of which was described in a paper read before the Section last year, was exhibited, and along with it, maps showing the departures from the mean distribution of air pressure and temperature during the same period. A number of new features in the movements of surface waters are disclosed, notably in connection with the distribution of Polar waters from the western Atlantic.

The samples of water were for the most part collected by ship-captains who kindly undertook to fill bottles at intervals during the course of their voyages, and to forward them to Mr. Dickson, with records of the various points at which their contents were obtained. The results show that there is a great range of variations in the distribution of temperature and salinity, and that the system adopted is quite adequate to their study. Sir John Murray testified to the value of the observations made, and strongly advocated the use of the Fahrenheit in preference to the Centigrade thermometer.

The fourth of the series of oceanographical papers read this morning was one by Dr. H. R. Mill, on "The Nomenclature of the Forms of Sub-oceanic Relief." He said that

The Royal Geographical Society is at present engaged in the investigation of the whole great subject of the terminology of geography, and at the approaching International Geographical Congress at Berlin the question of the terminology and nomenclature of the forms of the floor of the ocean is to be discussed by representatives of different countries. The fact that the forms of the ocean floor cannot be seen, but only felt out by soundings, makes their study one of peculiar difficulty. Some distinguished authorities believe that our present knowledge of the deep sea is too slight to justify any systematic nomenclature. Meanwhile each investigator introduces a set of names of his own, for the most part based on analogies with land forms visible to the eye.

It is obvious that there are two great classes of forms, elevations above and depressions below the general level of the ocean floor; but the question is how many subdivisions of each can be recognised as distinctive and deserving of generic names. I am inclined to put forward tentatively the following general scheme of terminology, premising that no attempt be made to localise any precise type of form unless a considerable number of soundings exists to define it:—

Depression.—The general term for any hollow of the ocean floor.

Basin.—A relatively wide depression, with comparatively gently sloping sides.

Caldron.—A relatively wide depression, with comparatively steeply sloping sides.

Furrow.—A relatively narrow depression with comparatively gently sloping sides.

Trough.—A relatively narrow depression with comparatively steeply sloping sides.

Wall.—Any submarine slope comparable in steepness to a precipice on land.

Floor.—Any very gentle submarine slope or nearly level surface.

Elevation.—Any inequality above the general level of the ocean floor.

Rise.—A relatively narrow elevation.

Bank.—A relatively wide elevation.

Shoal.—An elevation coming within five fathoms of the surface, so as to be a danger to shipping.

Shelf.—A nearly horizontal bank attached to the land and bordered seaward by a much more abrupt downward slope.

Any suggestions as to the forms which are really typical and the terms which are most appropriate for their designation will be carefully considered.

Sir John Murray thought our present knowledge of the floor of the ocean insufficient to enable us to adopt set terms when describing its features. Incidentally he advocated the expression of ocean depths in fathoms rather than in mètres.

The first paper of the afternoon was one by Colonel Sir John Farquharson, K.C.B., on "Twelve Years' Work by the Ordnance Survey."

His paper was illustrated by a series of charts showing the work accomplished in each of its various branches, and he laid on the table an extremely interesting set of specimen maps, which included a copy of the first Ordnance Survey Sheet issued by the Department in 1801. A discussion followed, in which Colonel D. A. Johnston and Mr. Crook took part.

The last paper of the day was by Mr. Vaughan Cornish on "The Sand-Dunes surrounding the Delta of the Nile."

The author visited Egypt in April-May 1899, in continuation of his work upon Sand-dunes (see *Geographical Journal*, March 1897, the first of a series of papers upon "Kumatology"). Observations of sand-dunes and allied phenomena were made upon twenty-three days along the line of the Suez Canal between Port Said and Serapeum, on the Syrian route from Kantara, in the neighbourhood of Ismailia, and on the line from Ismailia to Abu Hammad, between Cairo and Terieh, on the western margin of the Delta, and in the neighbourhood of Helwan and Sakara. About fifty photographs and eight drawings, suitable for reproduction, were obtained of sand-dunes, wind-erosion structures, and of tree-planting directed against the encroachment of sand. The photographs of dunes include both *barchanes* (or *medanos*) and the curious hollows which, in Arabia, are called *fuljes*, as well as gently undulating surfaces, covering the country like a mantle of snow, with no sharp ridge or slipping lee cliff. Measurements of ripples and dunes were made, and samples of sand were taken, from which (two only at present) micro-photographs have been prepared.

Ripples.—The author had previously measured twelve wind-formed ripples in the blown sea-sand on the Dorset coast. The average ratio of length to height was $\frac{L}{H} = 18{\cdot}4$. The least height was ·06 inch, and the greatest ·34 inch. These measurements were, for the most part, of one or two individual ripples. Mr. E. A. Floyer measured six of the largest kind of ripples on the El Arish route, and obtained $\frac{L}{H} = 17{\cdot}7$ with H from 6 to 10·6 inches. The author measured thirty-

seven *consecutive* ripples to leeward of a sand-dune near Ismailia. The ripples had an average height of 1·43 inches, and the average $\frac{L}{H}$ was 16·57. The appearance of these was intermediate between that of ripples where accumulation is rapid (which never grow large), and the large and nearly symmetrical ripples (? analogous to *sastrugi*), as much as 11 feet in wave-length, the formation of which is apparently accompanied by a considerable lowering of the general level.

Dunes.—A tract of a few hundred acres of small, but true, dunes (not ripples) on a sandy foreland, exposed during the fall of the Nile, afforded an opportunity for similar measurements.

Higher and lower dunes succeeded one another, and viewed transversely, the ridges were strongly undulating. Nevertheless a line having been marked out in the up-and-down-wind direction, the *average* $\frac{L}{H}$ for twenty-four consecutive dunes was found to be 18·04, average height 20 inches. Another set of measurements taken near the same line on the succeeding day, gave $\frac{L}{H} = 17{\cdot}89$ for twenty-three consecutive dunes. Apparently the ridges are formed of the nearly uniform ($\frac{L}{H}=18$) shape, and lateral inequalities are subsequently developed in the manner explained in the *Geographical Journal*, June 1898, pp. 637-9, but these do not affect the *average* $\frac{L}{H}$. The author hopes to make similar measurements of trains of larger dunes.

The straight, slipping lee cliff of dunes is caused by the undercutting of the eddy. In the dunes near Ismailia a progressive development of the profile form was observed. At first both windward and lee slopes are very gentle, and the highest point is near the middle. The summit apparently moves to leeward, and the lee slope becomes steeper; a slipping cliff is formed on the upper part of the lee slope. This pushes back towards the summit, and the windward slope grows steeper. Finally, windward and average leeward slope become of nearly equal steepness, and the top of the cliff coincides with the summit of the dune.

Dune Tracts.—The condition for formation of a dune tract in a sandy district is that the rate of travel of the sand should be locally diminished without a corresponding diminution in the supply of sand. The persistence of such condition may cause a stationary dune massif without fixation.

In the sandy district visited by the author the formation of a dune tract or dune massif appears to be chiefly determined by the presence of ground moisture, which gives coherence to the sand. Thus the boundaries of these massifs frequently appear inexplicable when an explanation is sought in the wind. Within the bounds of the massif, however, the modelling of the surface is explicable by the action of the winds. In the neighbourhood of Helwan, wind erosion of limestone and other rocks is very active over areas where there are no dunes. An examination of the wind-formed detritus showed a quantity of sand-sized particles sufficient for the formation of dunes; and the explanation of their non-formation seems to be that the sand-sized particles are too small a *proportion* of the whole.[1] According to this line of reasoning, dunes will only be formed where dust-formation proceeds slowly, for if dust be produced rapidly the proportion of sand-sized particles remains low.

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[1] Cf. *Geogr. Journ.*, June 1898, pp. 636-7.

Mr. Cornish's paper was illustrated by an excellent series of lantern slides.

The last meeting of the Section was held on Tuesday the 19th, when Mr. Rickmers gave an interesting account of his visit to the Karch-Chal mountains in Transcaucasia, lying about 30 miles south-east of Batum. The principal peaks, eight of which were ascended, rise on an average to 12,000 feet. Mr. Rickmers will probably deliver a lecture to the Society.

Mr. Rickmers was followed by Dr. Haddon, who gave anthropological notes on New Guinea and Sarawak. He exhibited sketch-maps showing the districts to which he referred, and lantern views showing the character of the countries and the types of their inhabitants. He explained how the nature of their natural surroundings affects their occupations or trades, and their mode of life.

Captain Wellby then read a paper on his travels through Abyssinia. He described King Menelik's capital, and alluded to the scarcity of wood, which has to be brought in from a distance of 15 miles. The king travelled southwards with an army of 70,000 men, and Captain Wellby accompanied him. The Abyssinian people are steeped in the most astonishing ignorance, but they possess pluck and energy, combined with an intelligence which merely awaits development. Two days' march south of the capital they arrived at the sacred hill of Zuquala, on the summit of which he discovered a lake said to be of unfathomable depth; and from here he was able to see the distant lake of Zuai, the first of a chain of lakes connected by running streams. On the banks of the third of these lakes they encountered a tribe which, to the best of his belief, had not previously been visited by white men. Captain Wellby then entered the country of the Walamo, a people credited with the power of transferring the feelings and behaviour of a devil into the body of a stranger. Thence he passed through a beautiful mountainous district with hills rising to 11,000 feet, and dropping down on to the plains steered for Lake Rudolph. He found the western shore an inviting land, affording abundance of game of all kinds. Arriving at the southern extremity of the lake, the expedition followed a westerly course for several hundred miles, discovered two sources of the Sobat river, and came in contact with many more tribes, the men of one of which stood fully 7 feet high. They then steered northwards for the outlying Sudan port of Nasser, which is on the Sobat, about 180 miles from its junction with the White Nile. They returned home by way of Khartum and the Nile to Cairo. A vote of thanks to Captain Wellby was proposed by Lord Lister.

In the afternoon Mr. Walter Wellman gave an account of his journey to Wilczek Land, and his winter residence in the Arctic. He aimed not merely at the discovery of new lands, but at the accomplishment of scientific work, and he also hoped to reach the Pole. He described some incidents of his journey, and illustrated his discourse with numerous excellent photographic slides. The meeting of the Geographical Section closed with a paper on "Oceanic Islands" by Mr. C. W. Andrews.

Sir William Turner has been appointed President-elect for the meeting at Bradford, which will commence on Wednesday, September 5th, 1900. The meeting of 1901 will be held at Glasgow, and invitations from Belfast and Cork have been received for 1902.

GEOGRAPHICAL NOTES.

By The Acting Editor.

ASIA.

Siam.—Of the 750 Europeans who reside in Siam, 201 are British subjects; next come the Americans, 135 in number, while the Germans are 97 and the French 50. The industry and commerce on a large scale are in the hands of the British; they have at Bangkok three banks, they possess forests and mines, teak saw-mills and factories for the decortication of rice, building-yards for houses and ships. English is the language used between Europeans of different nationalities and in communications to the Government, and it is taught in the schools. The Americans are almost all missionaries. Chinese monopolise the retail trade and small industries; some of them are rich, and own large factories and sea-going vessels, and build boats for river navigation. The rich Chinese are usually the opium-dealers, gambling-house keepers, and retailers of spirituous liquors.

The state of the country is in many respects satisfactory. Justice is regularly administered, and the finances are in an excellent condition. There is no public debt, and the revenue is collected without difficulty. Works of public utility have been constructed without recourse to loans. For some time a British functionary, assisted by a couple of inspectors, has been attached to the finance department as "financial adviser." The revenue is increasing, and exceeds the expenditure. King Chulalongkorn is an enlightened monarch, and his late visit to Europe has made him desirous of introducing several reforms as soon as possible, and, above all, to construct ways of communication across his territory. He understands that the surest means of a small State to preserve the integrity of its territory is to make good use of it, and to connect the interests of international commerce with the question of national independence. On the other hand, he fears to intrust large enterprises to foreigners, lest any small difficulty should prove an excuse for calling in the gunboats of their country.

The climate is tropical but healthy, and the mortality among Europeans is low. The native population numbers about ten millions, mostly settled in the valley of the Menam. The people are gentle, peaceful, and very hospitable. They occupy themselves in agriculture and commerce. Labour is plentiful and cheap, owing chiefly to the constant immigration of Chinese.

The country may be divided into three regions. The northern forest region on the high terraces of Indo-China, where the upper waters of the hydrographical system of the country rise, has been little explored or exploited; a few companies are engaged in the teak trade, but new concessions are refused by the Government in order to preserve a supply of timber. A systematic cultivation of india-rubber would certainly be profitable. The central region, drained by the Menam, is a country of fertile alluvial soil, partly converted into rice-fields. The Menam below the confluence of the Meping throws out a number of arms, connected by a network of small canals, and forms an immense delta nearly as large as Belgium, where rice, which is one of the chief riches of Siam, is grown in abundance.

The crop might be trebled or even quadrupled, for there are extensive lands now unproductive which could easily be converted into rice-fields. A private company, the Siam Land, Canals, and Irrigation Company, has obtained concessions for the purpose. In the same region, chiefly in the eastern districts, cattle-breeding is carried on successfully, and, though roads are wanting, large numbers of cattle are exported from Bangkok.

The southern zone, on the peninsula of Malacca, is essentially different from the others. It is a narrow chain of mountains rising in terraces from the coast. The Siamese part of the peninsula is not less rich than the British. Coal has been reported from several points, but at present Siam is supplied with this article by the British. Numerous rich deposits of tin exist in the Siamese part of the peninsula, but are not yet worked methodically. Gutta-percha is another important natural product. The whole produce of the world is barely 4000 tons, and the demand is increasing. Certain good kinds are known by the names of two Siamese districts. And mines and forests are not the only resources of this part of Siam; the lands, sheltered by the mountains on the one side, and exposed on the other to fresh sea breezes, are of extreme fertility.

The riches of Siam are for the most part yet untouched. Several raw materials of commerce have still to be utilised, and teak and rice are the only exports. But Siam is capable of becoming as commercially important as Burma.

The port of Bangkok, a town of 60,000 inhabitants, is excellent. It is situated on the Menam, a river 500 yards broad, with a depth of 45 to 60 feet. Below, the river, 25 miles long, can be navigated by the largest ocean-going vessels, and above, is accessible to flat-bottomed stern-wheeled steamers for a distance of 280 miles. The great drawback to Bangkok as a port is the bar at the mouth of the river, three miles from the coast, where vessels have generally to wait for the tide before they can cross. For several years the merchants of Bangkok have been agitating for the canalisation of the river across the bar, and though only a preliminary examination has at present been made, no doubt this great work will be decreed before long. But the development of Siam, and indeed of the whole of Indo-China, demands the construction of railways. One from Bangkok to Paknam, 13½ miles long, has been several years in activity; another from Bangkok to Korat, 159 miles, is open to Genkoi and is being continued, as also a branch towards Prabat and Lopburi; and surveys have been commenced for a line from Bangkok to Pechaburi. The most important railway projected is one to traverse the kingdom from south-west to north-east. From its terminus at Ranung, on the bay of Bengal, it will gain the capital by the isthmus of Krau and Pechaburi, will ascend the Menam and reach the Upper Mekong at Luang-Prabang, where it will form a junction with the railways of Tonkin. It will traverse the mining zone from Ranung to Pechaburi, the agricultural from Pechaburi to the lakes, and the forest zone thence to Luang-Prabang. It would considerably shorten the distance between Colombo, Bangkok, Saigon, and Hanoï, and if it were continued across the populous province of Kwang-si to Canton, the consequences to trade would be enormous.

A series of lines, for most of which concessions have been already demanded, would join this trunk line—a southern line, from Chumpanu to Tringanu, to collect the minerals, gutta-percha, and vegetable products of the Siamese districts; a prolongation of the Paknam railway south-eastwards towards Simaharatsa; a line westward to Kanburi, with a branch from Nakon-Shaisi to Ratburi; and another north-westwards towards Rahang and Chieng-mai, through the forest regions.—*Le Mouvement Géographique*, No. 27, 30, and 34.

AFRICA.

Professor Schirmer on the Ethnography of Aïr.—In the notice of Von Bary's *Journal* on p. 161 the reviewer remarked that the translator, Professor Schirmer, showed himself "keen to minimise the evidence of Hausa influence," and expressed a doubt as to the paragraphs omitted in the translation. Professor Schirmer has since forwarded a copy of these paragraphs, which contain nothing bearing on the question of Hausa influence, at the same time pointing out that an important sentence, quoted by Professor Ratzel, showing the extension of the Hausa language to a village between Ghat and Ajiro, is not omitted, but was not recognised by our reviewer because Professor Ratzel identifies this village, not named by Bary, as Guri, while Professor Schirmer identifies it with Iferuan.

Professor Schirmer has not only cleared up these doubtful points, as our reviewer is glad to acknowledge, but he has also sent us the following very interesting communication on the ethnology of Aïr, and the nature of the Hausa influence in that country:—

"The Hausa influence in Aïr has been of divers kinds—(1) Religious: in the few mosques that exist, prayers are offered up for the Emir-al-Mumenin of Sokoto, as for the other 'commanders of the faithful' (E. du Bary, translation p. 159). (2) Political: it does not appear that since the beginning of this century Aïr has formed part of the Hausa kingdom. This may be gathered from the narratives of Bary, Staudinger, Richardson, and Barth, and also from the manuscript of the Sultan Mohammed Bello of Sokoto (Enfak el missuri fi tarikh Belad et Takrur) brought to England by your illustrious fellow-countryman Clapperton. There have existed between Sokoto and the chiefs of Aïr only general amicable relations based on reciprocal needs. This is a point generally conceded. (3) Ethnographical and Linguistic: here we have a series of remarkable facts. The Kel-Owi have a much darker complexion than the other Tuareg (Bary, pp. 72, 122, etc.). They speak Hausa fluently as well as their own Berber dialect (see Barth, *Reisen*, i. p. 374; Bary [trans.], pp. 92, 127, etc.), in some villages more commonly than Berber (Bary, p. 112). The distinction between nobles and *Imrhad* (serfs) no longer exists in the Aïr, doubtless owing to frequent alliances with the Hausa element (Bary, p. 181). The Kel-Owi fatten their women after the Sudanese custom (*ibid.* p. 185). These facts are susceptible of explanation in several ways.

"(*a*) The Tuareg, as your reviewer correctly states, found in Aïr a darker-skinned people, and intermarried with them. I agree with him in accepting the tradition given by Barth, and I have, following an ingenious remark of the immortal explorer, recalled in my book *Le Sahara* (pp. 237, 327) the fact that Aïr has been occupied by this dark race for more than twenty-three centuries. But they cannot be identified with the Hausa people, a half-caste and mixed people *par excellence*. 'Aïr,' writes the Sultan Bello referred to above, 'was formerly in the hands of the Soudan inhabitants of Ghoobér. . . . My friend, the prince of the faithful, Mohammed Elbákery, son of the Sultan Mohammed El-ad-dal, informed me that the inhabitants of Kashnah, Kanoo, Zag-Zag, Dor or Dowry, Ranoo, and Yareem, originated from the children of the above-named slave Ba-oo, but that the people of Ghoobér are free-born, because their origin was from the Copts of Egypt who had emigrated into the interior of the Gharb or western countries. This tradition he found in the records which they possess.' (*Narrative of Travels and Discoveries in Northern and Central Africa*, by Major Denham, F.R.S., Captain Clapperton, and the late Doctor Oudney, vol. ii. p. 450: London, 1828.) And Barth does not hesitate to call the Gober 'der beträcht-

lichste und edelste Theil der Hausanation, der jedoch nicht zu der reinen Negerrasse gehört, sondern ursprünglich enge Verwandschaft mit Nord-Afrika gehabt zu haben scheint. Von diesem Standpunkte aus ist es keineswegs als eine absurde Angabe zu betrachten dass Sultan Bello den Goberstamm Kopten nennt.'—(*Reisen*, i. p. 369.) We know no more at the present time. The country of the Gober, claimed by the dynasty of Sokoto, but in perpetual hostility with it, remains one of the most mysterious regions of Africa. The Goberawa are one of the elements constituting the present population of Aïr, but we cannot yet estimate the importance of this element, nor even classify it ethnographically.

"(*b*) What complicates the question is the presence of another dark-skinned element in Aïr—the modern Hausa element, slaves and descendants of slaves. Of the innumerable victims carried off or bought by the Kel-Owi ('the Kelouees,' Richardson says, 'are the greatest slave-dealers of the Sahara'), how many have remained in Aïr? M. Ratzel, speaking of this importation of Negroes, says that it is not easy to exaggerate its importance (*Völkerkunde*, iii. p. 157), and the judgment of the eminent ethnographer is confirmed by all the observations of modern travellers. Bary came across a village entirely peopled by slaves (trans., p. 156). In Aïr the slave seems to be everywhere, and most frequently he is a Hausa. The Kel-Owi, in Richardson's time, took part in the raids of the Gober. Even in 1877 the Sultan of Gober made a victorious incursion as far as the gates of Katsena, and carried off a large number of persons into slavery, so that the Kel-Owi expected a fall in the article (Bary, p. 193). It is known that among the Tuareg of the north the importation of slaves has been very considerable, for, according to the nobles, the vassal Imrhad tribes of dark complexion are descended from the freed sons of black female slaves (Duveyrier, *Les Touareg du Nord*, p. 337). And many of the Imrhad of Ghât still understand Hausa (Barth, *Reisen*, i. p. 256). What wonder, then, if this language is spoken freely in Aïr? Here the effect of the slave element is the more manifest, in that, contrary to the custom among the northern Tuareg, 'the son of a Kel-Owi and of a slave is free like his father, and has the same rights (statement of the Marabout Haj Iata to De Bary, p. 181).

"(*c*) But this is not all. Is it known what races besides the Berbers and Gober have left their traces in Aïr? Were the Kel-Owi pure Berbers when they established themselves there? Perhaps so, if it is true, as Barth was told, that they came thither from the north-west; on the contrary it is by no means probable if, as Bary heard, they came from the southern border of the Sahara, between Kuka and Zinder. Again, has not Aïr been subject to the domination of the Sonrhaï? and does not Mohammed Bello say that the conquests of a king of Kebbi 'extended to Kashnah, Kanoo Ghoobér, Zagzag and the country of Aaheer'? (*loc. cit.* p. 452).

"One sees how obscure and complex the ethnical conditions of the frontier countries of the Sahara and Central Sudan still are. I hope that the mission under the direction of my fellow-countryman and friend, Fernand Foureau, will aid in throwing some light upon them. Now that diplomacy has removed all causes of disagreement, by defining the spheres of influence, it is to be hoped that the travellers and learned men of France and England will unite their efforts to unravel the past history of these peoples, and in particular devote themselves to the study of the Gober dialect, and to the search for the written sources mentioned in the document brought home by Clapperton. Their activity may prove fruitful, and thus we may hope for a solution of the ethnographical problems set forth by the investigating genius of Barth.

"What was the language of the ancient Gober? What constitutes the

'certain undoubted affinities' noted by Barth between the Hausa idiom and that of ancient Egypt (*Sammlung und Bearbeitung Central-Afrikanischer Vokabularien*, p. cii.), and what do they signify? Are they an indication of the origin of the Gober race, or simply the vestiges of ancient connections which existed between ancient Egypt and the country of the Blacks?"

The Trans-Saharan Railway.—M. Bouty discusses in the *Bull. de Géographie et d'Archéologie d'Oran*, April-June, three proposed routes for this long-desired line. The first of these, the western, consists of three sections, namely, from Oran to Djenien bou Resg; from Djenien bou Resg to Igli; and from Igli to Tuat, whence it might be connected with the Niger. A railway has been for some years in activity between Oran and Aïn Sefra, and the prolongation to Djenien bou Resg will soon be opened. Thence to Igli the route follows the left bank of the Wed Dermel towards Aïn Sefra of Figuig, leaving this oasis on the west lest any diplomatic difficulty should arise with Morocco, and then descends the Wed Zusfana to Igli, a very important ksor at the confluence of the Wed Zusfana and Wed Ghir, running streams which form the Wed Messaura. No great technical difficulty is presented on this section, as the country is flat and slightly sandy. The construction of this section, about 150 miles long, would firmly establish French influence in a rich and productive and well-peopled country.

The second section, from Igli to Tuat, would follow the valley of the Wed Messaura, through the midst of a number of ksors, more than 185, surrounded by whole forests of date palms, and would reach Taurirt in Tuat after a course of 280 miles. To the east is Gurara, an oasis with 114 villages, one of which is at most 50 miles from railway route; and also to the east, to the right of Taurirt, and about 60 miles distant, is Tidikelt with 51 ksors. Altogether, the population of the district through which this section runs numbers 459,300. The country is flat and no difficulties have to be overcome in constructing a line. The whole distance to be covered from Oran to Tuat is about 780 miles.

The continuation from Tuat to the Niger might either be carried to Tosaye through Tin Tenaï, Aïn Arlal, Tfinok on the Wed Teghazrt, Timissao, and Es-Suk, or to Timbuktu through Wallen, Inzize, Azauat, and Taganet. The latter route is perhaps preferable, as Timbuktu is garrisoned by French troops, and because of the influence that the French will establish over the Auellimmiden. The length of the section from Tuat to Timbuktu will be over 700 miles.

In some parts of Algeria the water is too salt to be used in locomotive boilers, but there is abundance of fresh water as far as Taurirt. The Wed Ghir, known in the time of Ptolemy as the largest river of the Sahara, waters the great valley of the Messaura into the heart of Tuat. It descends from the southern slope of the Great Atlas, and is fed by the snows and glaciers of the range. The cost of construction, considering that the section between Krafallah and Aïn Sefra cost 50,000 francs a kilometre (about £3220 per mile), and allowing a large margin for all contingencies, M. Bouty estimates at £640,000 for the section from Djenien bou Resg to Igli, and at £1,600,000 for that from Igli to Tuat. The gauge would be that of the railways in operation, namely, one mètre, or about $3\frac{1}{4}$ feet. The number of inhabitants along the line of railway between Djenien and Taurirt would be about 986,000, and 923,000 between Taurirt and the Niger, while 5,132,000 in addition would be within more or less easy reach of the railway. There are some 5,400,000 date-palms on the route, and others in the districts traversed make up the whole number to about 11,100,000, and the weight of dates exported from the former number would be on a moderate

estimate 200,000 tons. These, with the imports to Tuat, amounting also to 200,000 tons, would pay a tariff to the railway of not less than £1,080,000, yielding an estimated annual profit of £280,000.

The eastern route continues the line from Biskra, which is 180 miles from Philippeville, the starting-point of the line. From Biskra to Ouargla the distance is 248 miles, and this section would act as an outlet for the trade of the Mzab. The country is well known, is flat, and presents no difficulties. But beyond Ouargla as far as Temassinin there is a region of dunes, 220 miles long and several degrees of longitude in breadth, where there are no inhabitants, and the springs are few and insignificant. After Temassinin the great Hoggar mountains with their steep escarpments have to be crossed, and on the stretch of 440 miles to Bir Garama there is water only at Amguid, and this place is in the midst of the territory of the Tuareg, wandering robbers, the terror of the desert. As for the route on to Lake Chad, it is impossible to say anything about it, as it has only been visited by a few travellers who did not think of railways and the country suitable for them. The level of the country rises from 315 feet above sea-level at Ouargla to 1230 at Temassinin, and 4900 at Amguid. The total distance from Philippeville to Barrua on Lake Chad is about 1950 miles. M. Sabatier says that, with the exception of some isolated tracts, this route traverses the desert in all its nudity, where there are no settled inhabitants, no animals, no natural products of the soil.

On the central route little need be said, for over a considerable part of its course it is identical with one or the other of the former. There is already a line from Algiers to Berrouaghia, a distance of 84 miles. This would be prolonged for some 190 miles to Laghouat, an advantageous enterprise involving no difficulties. Then the route diverges eastward across the Mzab to Ouargla, where it joins the eastern route, but there is little probability that this section will ever be constructed, as the Biskra-Ouargla line would be more important and more easily made. Then there is a proposal to connect Laghouat with Tuat also. On this stretch the country, for a distance of at least 250 miles, is intersected with numerous deep ravines, and the *hamada* offers no supplies of water or products, being bounded on the east and west by the Erg. Indeed, the whole tract as far as Taurirt, over 600 miles from Laghouat, is destitute of natural resources, except Golea. The cost of construction from Berrouaghia to Golea, 400 miles, would probably amount to £2,000,000, and from Berrouaghia to Ouargla, 340 miles, about £1,600,000.

At a meeting of the Soc. de Géogr. Commerciale de Paris (*Bulletin*, Nos. 3 and 4), M. du Fresnel stated that a German company contemplates constructing a line from Tripoli to Lake Chad. The promoters say that Tripoli is in the direct line between the lake and the centre of Western Europe, and is better situated to supply the ports of the Adriatic, Genoa, Marseilles, and the Black Sea ports, than Tunis and Gabes, besides being the nearest town on the Mediterranean to the lake.

M. Paul Bonnard considered Bou-Grara with its lake, double as large as that of Bizerta, as the proper terminus of the line to Lake Chad. The route he advocated passes through or near to Ghadames and Ghat, and then follows the track of Monteil through Bir el Amar, Kauar, and Bilma. It is the shortest of the French routes, the most advantageous for the transport of merchandise, and the easiest for railway construction and maintenance, having no mountains, and being well provided with water, especially from the frontier of the Tripolitan territory to Lake Chad.

Colonisation in Tunis.—Owing to the mountain ridges running almost parallel to the sea, and arresting the northerly winds, so that the rain cannot be equally

distributed, a great variety of climate is found in this country in a very restricted space. In the north the climate and vegetation are similar to those of Europe, and here are the forests of the Kroumirie ; but towards the interior the aspect of the country changes. The valley of the Medjerda, partly under cultivation, is encroached upon at many points by a fairly dense bush, which conceals an excellent soil. Farther inland the valleys expand still more, and Tunis exhibits a peculiarity which distinguishes it from Algeria. Whereas in the latter country there are three distinct regions—the mountain zone, the central plateau, and the narrow valleys of the Sahel opening out to the sea—in Tunis the Atlas divides, giving room for fine broad valleys. In the great central plains is a mixed earth capable of producing excellent pasturage when it rains, which unfortunately is not often, at any rate not regularly. During the three years M. René Millet spent in Tunis, for example, the plain of Kairouan was a desert ; for the past two years, on the other hand, excellent crops have been harvested. Towards the sea the soil becomes sandy, and is suitable for the growth of the olive. This cultivation is of great importance, and extends, with interruptions, all along the coast from Cape Bon to Sfax. Beyond is the interesting region of the oases Gafsa, Gabes, the Djerid. Then past Gabes there is a circular basin, ten to thirteen miles broad, very suitable for cultivation. The Government has succeeded in settling here some families of semi-nomads, and has dug wells for them. The Berbers are accustomed to till the ground with weapons by their side, and store their crops in curiously fortified granaries, but now these have been abandoned, and the Berbers are beginning to live on the spots they have chosen, and seem content to be no longer the sport of fortune.

Enough remains of the ancient civilisation to show its nature. The Arab invasions laid waste the interior of the country, but on the coasts, and particularly in the south, there are numerous vestiges of Roman settlements. All the olive plantations date from Roman times, for at that period the prosperity of the central part of the country depended on the olive. All the ancient buildings were situated on the heights, as the low grounds are fever haunts, and the French colonists are beginning to perceive that it is better to settle on the hills than in the midst of their fields. The Romans irrigated their fields, making in particular an ingenious use of dams to force the torrential waters of the weds over the land. The colonisation of the Romans was aristocratic, the occupation of the masters consisting only in superintending the labour of the natives and of slaves, and therefore was carried on under very different conditions from those which now prevail. In these days the means of transport are far superior, and the credit system has been developed, but, on the other hand, competition obliges the colonist to calculate to a penny the price of his produce.

The first lands acquired in Tunis were devoted to the cultivation of the vine. The vineyards of France had then been ravaged by the *Phylloxera*, and great expectations were founded on the production of wine in Tunis. The French vineyards have been restored, and the prices returned to their normal rate, but still the cultivators obtain very fair profits. For some years past the greatest development has taken place in properties of moderate and small areas. The former estates have an acreage of 750 to 1000, while the small properties vary from 25 to 120 acres. In 1897, the lands owned by Europeans in Tunis amounted to 1,383,800 acres, of which Frenchmen held 1,154,000. There are 1215 properties, or 77 per cent. of the total number, with areas of less than 250 acres each, and nearly 900 of these have less than 25 acres each, so that peasant proprietorship has admirably succeeded in Tunis. Some of the large estates yield a profit of 7 to 10 or 12 per cent., while others of more moderate extent bring in to their

owners a very comfortable income. Many of the colonists now combine different forms of cultivation, so that in years of drought, when the pastures and the corn lands are less remunerative, they recoup themselves by their vines. The smallest plots are cultivated by Italians, who are very abstemious and seem to have no wants. They will settle on a piece of stony ground, abandoned long ago, pull out the stones with their hands, and plant vines; and their efforts have been crowned with success.

M. Millet points out that Tunis offers an excellent field for the employment of French capital. Whereas in France money is lent at 3 per cent., in Tunis it can be invested at 6 per cent. and more, generally at 7 to 8 per cent.—*Bull. de la Soc. de Géographie Comm. de Paris*, Nos. 3 and 4.

New Railway in the Congo State.—By means of the railway from Matadi to Dolo, and the steamers which ply thence to Stanley Falls, the eastern and central districts of the Congo State enjoy uninterrupted communication with the world. But beyond the falls, the rivers which open the routes to the east are all obstructed with rapids, and therefore railways are necessary. The Congo State has taken the first steps towards the study of a vast project, whereby the line of communication will be continued to the great lakes. There are great difficulties to be overcome. Beyond Stanley falls and the Congo-Lualaba the great equatorial forest stretches across three degrees of longitude. Farther on, the land rises in a succession of terraces up to the watershed, above which mountains rise to a height of 8000 feet above the level of the Lualaba. Then to the east of this line, where the Aruwimi, Lowa, Urindi, Elila, and other rivers rise, the land sinks in abrupt slopes, almost cliffs, at the foot of which lies the narrow fissure which contains the Albert (2126 feet above sea-level), the Albert Edward (3074 feet), Kivu (4888 feet), and Tanganika (2664 feet) lakes.

A year ago, after some rough surveys had been made, the construction of two lines was contemplated. One of these was to run from the lower navigable course of the Itimbiri to the valley of the Welle, and thence to Rejaf on the Nile, and the other, starting from Luzumbu on the Sankuru, and crossing the basins of the Lomami and Kamolondo, to gain the western shore of Tanganika by the valley of the Lukuga. This project has been abandoned, and it is now intended that only one line shall be carried up towards the watershed. Stanley falls has been chosen as the point of departure. The railway will be carried up the valley of the Tshopo, or along the watershed between this river and the Kinena, eastwards to the plateau on which are situated the sources of the Lenda, affluent of the Aruwimi, and of the Oso, affluent of the Lowa. Here the railway will bifurcate to gain the extremity of Lake Albert, and thus connect the basin of the Nile with that of the Congo, and on the south to reach the northern end of Lake Tanganika, and thus establish communication between Stanley falls and the Stephenson road. The work of survey has been intrusted to Mr. Adam, an engineer who sailed from Antwerp on January 6th, accompanied by the engineers MM. Dutoit and Cotigny. The total length of lines to be constructed is estimated provisionally at fully 1200.—*Le Mouvement Géographique*, June 25th.

AMERICA.

The Timber Line in the United States.—Mr. Henry Gannett states that the upper limit of growth differs greatly in altitude in the United States in accordance with the latitude, elevation of the general surface, exposure, etc. It is a somewhat indefinite line, as the forests do not end abruptly, and is sometimes thrown into irregular curves by gullies, bare rocks, etc. The height of the timber line

above sea-level has been measured on most of the mountain ranges which rise above it. On Mount Washington, in the White Mountains of New Hampshire, it stands 4150 feet above sea-level, and on Mount Marcy, in the Adirondacks of New York, at 4900 feet, though the two groups of mountains are nearly on the same latitude. These and Mount Katahdin in Maine are the only elevations east of the Rocky Mountains which rise above the snow-line, for the southern Appalachians, though higher, are in a much lower latitude. The cordilleras stand, for the most part, on a high broad plateau, ranging in elevation from 4000 to 10,000 feet above sea-level, being highest in Colorado, where also the timber line is highest—having an average altitude of 11,500 feet. In New Mexico the height of the timber line is no greater than in Colorado, for the lower latitude is counterbalanced by the diminished height of the plateau. Except in the Sangre de Cristo range there is scarcely any mountain that rises above the forest level, and in Arizona only one peak, as far as is known, the San Francisco mountain, rears its head into altitudes too great for tree-growth. It is an ancient volcano on a platform 7000 feet above sea-level, and trees grow on it up to 11,500 feet.

In the Wind River range of Wyoming the timber line is at about 10,200. Farther north, on Mount Blackmore, it drops to 9500 feet, and on Mount Delano, near the north end of the Absaroka range, to 8800; thence it fully maintains its level up to the northern boundary. The ranges to the west in Montana and Idaho nowhere reach the timber line, which appears again in the Cascade range of Washington, though at a much lower level than at the same latitude in Montana. In Northern Washington it runs about 5500 feet, and gradually rises southwards to 10,700 feet in Grizzly Peak. The effect of the great plateau on which the mountains stand is plainly perceptible in the height of the timber line. It is well known that this great plateau, though several thousand feet above the sea, has the same temperature as the lowlands in the same latitude, and, as the height of the timber line is essentially a question of temperature, its great elevation in these mountains is to be expected.

In the Cascade range, Sierra Nevada, and San Bernardino range, the timber line gradually rises from 5500 in Northern Washington to 11,700 feet in southern California, over a distance of 14 degrees of latitude, the conditions, except latitude, being much the same throughout. A table of heights and latitudes shows, in spite of some irregularities, an average change of nearly 500 feet for each degree of latitude. At this rate the timber line would reach sea-level at 60° N. lat., where it stands, in fact, 3000 feet above the sea. The rate of descent therefore diminishes as the latitude increases.

In the United States the mean annual temperature changes about 1·7° with each degree of latitude. At Duluth, Minnesota, in lat. 46° 47′, it is 39°; at New Orleans, Louisiana, in lat. 30°, it is 67·5°. Also the mean annual temperature changes 1° for every 300 feet, more or less, of elevation. Therefore a degree of latitude corresponds roughly to a change of elevation of 500 feet, which has been shown to be the change in elevation of the timber line. Again, knowing the height of the timber line on a mountain, and the mean annual temperature of a station at its base, and taking the fall of temperature as 1° for every 300 feet of vertical altitude, the mean annual temperature of the forest limit may be found. Mr. Gannett calculates it from a large number of cases to be on an average 29·6°. The discordance in the results, ranging over 6°, is probably due to the minor causes of variation in the height of the line, such as slope, exposure, soil, etc.—*Bull. of the Am. Geogr. Soc.*, vol. xxxi. No. 2.

The Commercial Aspects of an American Interoceanic Canal.—Dr. Joseph Nimmo maintains that an inquiry into the advantages of a canal across Central America

should have been held by the American Congress before the engineering questions were considered. Neither the Nicaragua nor the Panama canal would afford the shortest or the most practicable route for the trade of the Atlantic seaports of the United States, or for the trade of the countries of Europe with Asia or Australasia. The distance in nautical miles from Manila to New York is 11,565 by the Suez canal, and would be 11,746 by the Nicaragua canal; and from Manila to London the distance is 9600 miles by the former, and 14,680 by the latter route. Thus the Suez route has an advantage of 181 miles over the Nicaraguan route for the trade of New York with Manila, and an advantage of 5080 miles for the trade of London with Manila. Moreover, the Suez canal route is much better provided with coaling facilities, and the canal is at sea-level, whereas the Nicaragua canal involves 220 feet of lockage; so that the advantage of the former may be estimated at 1500 miles for the trade of the Atlantic ports with Asia, and at fully 6000 miles for the trade of Europe.

The rainfall at the east end of the Nicaragua canal has amounted to 25 feet in a single year, whereas the average at Suez is only 2 inches, and a careful observer has affirmed that the estimates made in the United States ought to be multiplied by $2\frac{1}{2}$ in order to obtain the cost of earthworks which would withstand the effects of this enormous precipitation.

It has been claimed by advocates of the canal projects that the trade between the Pacific coast and the part of the United States east of the Rocky mountains would afford a large amount of traffic for the canals. About two-thirds of the population of the United States live west of the Appalachian range, and the chief commerce of the Pacific coast is with the region between this range and the Rocky mountains, and the average distance between the centres of production and consumption east and west of the Rocky mountains by the railways is about a third of the average distance by the Nicaraguan or Panama routes. The railway route is also much superior in respect of speed, facilities for the collection and distribution of freights, and the avoidance of the trans-shipment of cargo necessary on the canal route. Passengers, mails, bullion, and perishable goods would always be forwarded by rail. Raw materials and heavy products are now forwarded extensively by the railways, the rates of which are only about one-fourth of those which prevailed in 1870. Cotton can be transported more quickly and at less expense from the southern States to Asia through San Francisco, the difference of distance being 2000 miles in favour of the overland route; and the current prices of coal at Atlantic and Pacific ports show that coal cannot be transported profitably from the mines of Virginia to San Francisco, the canal toll being assumed to be $1.80, the present Suez rate. The distances from Chicago to San Francisco, 2356 miles by rail direct, and 5803 by the Nicaragua canal route, show the absurdity of the notion that any benefit would be derived from the canal by the great cities of the interior. Nor ought the seaport towns of the Pacific coast to look with favour on a project that might divert their trade with Asia and Australia to the Atlantic ports.

Sailing vessels would not use the canal on account of lack of wind and towage charges, and in the year 1898 the tonnage of sailing vessels in the United States was 2,377,815 tons, and of steamers 2,371,923 tons. Most of the trade of the Pacific ports with Europe is carried on by sailing vessels, just as much of the trade of Great Britain with Australia is carried on by sailing vessels *viâ* the Cape of Good Hope. As to the commerce of the west coast of South America which centres at Valparaiso, it is carried on in steamers that trade at the ports on the east coast. Besides, many of the products are essentially sailing-vessel cargoes, consisting mainly of nitrates, copper, wheat, coal, manganese ore, and barley.

The records of commerce across the isthmus of Panama throw light on the question of the utility of an interoceanic canal. Opened in 1855, the railway across the isthmus, 47½ miles long, continued to be the principal avenue of commerce between the eastern and Pacific States of the Union until the opening of the first trans-continental line, the Union and Central Pacific, in 1869. The value of the merchandise transported between San Francisco and New York across the isthmus in that year was over $70,000,000, while in the following year it fell to about $18,500,000, and in 1897-98 amounted only to $4,887,289.

Professor Emory R. Johnson regards the prospects of an interoceanic canal more hopefully, but he does not support his opinion by facts and figures so thoroughly as Dr. Nimmo. Between San Francisco and New Orleans the route will be shortened by 11,000 miles, if vessels use the canal instead of sailing round Cape Horn, and from San Francisco to Liverpool by 7000 miles. Through the Straits of Magellan the saving of distance by steamers will be 2000 miles less. Valparaiso will be brought 1000 miles nearer to the Atlantic ports of the United States than to Europe. Professor Johnson points out the advantage to the United States navy, and the expense which, in the absence of the canal, must be incurred by building more men-of-war for the Pacific. He believes that a canal will largely increase trade, as the Suez Canal has done, and that without injuring the railways, but he does not explain clearly how this trade will come into being, or show by examples the superior advantages of the canal route.—*The National Geographic Magazine*, August.

AUSTRALASIA.

The Bismarck Archipelago consists of three large and twenty-three smaller islands or groups. Neu-Mecklenburg (New Ireland), in the Admiralty group, is surrounded by a chain of numerous islets, and a large number lie off the coast of Neu-Pommern (New Britain), the southern island of the group, and connect it with Neu-Mecklenburg. These, as well as Neu-Hannover, have coasts much indented, affording good natural harbours. Neu-Mecklenburg has Port Breton on the south and the small bay of Labur and Nusahafen on the west coast; on the east coast there are a few openings in the reef passable only by boats. Except along the northern edge of the Gazelle peninsula, Neu-Pommern, there has been no proper exploration.

The southern half of Neu-Pommern runs east and west. The interior seems to be formed of a mountain nucleus. At the western extremity two extinct volcanoes raise up their conical summits, and are connected by their ejectamenta with the main mass; these are named the Below and Hunstein mountains. A chain of old volcanoes thrusts itself out towards the north, of which the best known is Pyramid mountain. Along the south coast are some large rivers and plains. There the mountains run in several ranges north-eastwards. On the west coast are two active volcanoes, Vater and Südsohn.

The Gazelle peninsula consists in the south of a number of parallel chains running from south-west to north-east, and culminating in the Baining mountains, at a height of about 3900 feet. The smaller northern part is occupied by a plateau of accumulation, much indented by valleys running north and south. The centres of volcanic activity were the Varzin and the inner parts of Blanche Bay, afterwards the outer volcanoes Nord and Südtochter and Mutter, and finally the crater opposite Matupi. The escarpments of the plateau sink steeply to the sea and to the hollow, 7½ miles broad, which separates it from the Baining mountains. The ground of this northern part of the peninsula consists of pumicestone resting on a coral base; in some places it is 300 feet deep and more. The Baining

mountains exhibit coral formations up to almost 2000 feet. In the rivers stones of recent origin are found, and farther in the interior mica and quartz. The east coast of the peninsula is not easily accessible, except at a few bays, and navigation along the west coast is difficult, though anchorage is found nearly everywhere close to the coast, and Powell harbour can accommodate vessels of 1000 tons.

Neu-Mecklenburg consists of three or perhaps four parts, probably originally divided. The broad southern section, with its narrow offshoot, the Rossel mountains, extends to the little bay of Labur, where there is a deep gap, beyond which the land rises again in the Schleinitz range to a considerable height. A second gap at Baneras is succeeded by another rise in the land which sinks to the low northern end, which must be regarded as a fourth, and the most recent, section of the island. Little is known of the interior and its geological formation. Eruptive and archæan rocks do not apparently crop out, and Boudouin, doctor of the last enterprise of the Marquis de Rays, held that the island was formed by an upheaval which did not break through the overlying calcareous deposits. These indicate plainly a gradual elevation of the land, forming on the west coast seven or eight distinct terraces.

Neu-Hannover is undoubtedly volcanic. The main mass consists of highlands clothed with forest, joined on the west, towards Cape Queen Charlotte, by low land of coral origin. The north and east coasts are low with local swamps, while the south and west coasts have a steep slope with only a narrow strip of level ground beside the sea.

The reef islands are all of similar formation. Reefs with abrupt edges protect the islands and islets, most of which rise very little above the water, from the encroachment of the waves. On Neu-Lauenburg (Duke of York island), Nissan, and the Hermit group the limestone rocks rise in some places to a height of 160 feet. Otherwise the islands are low and always densely wooded. In most of them there is no fruitful soil, and the natives have to subsist chiefly on coco-nuts, fish, and shell-fish.

Trade is developing in the Bismarck Archipelago, the natives becoming more eager to obtain European goods. They bring for sale copra, bêche-de-mer, pearl shells, tortoiseshell and ivory nuts. The islands yield a variety of useful timber, but it is difficult to get the timber to the coast in the absence of roads. There are also one or two plantations of coco-palms and cotton, owned by Germans.—*Mitth. aus den Deutschen Schutzgebieten*, Bd. xii. Heft 2.

MISCELLANEOUS.

The Dutch Deep-Sea Expedition under Professor M. Weber arrived at Makassar on board the *Siboga* on May 10th. Great depths were sounded in the Flores sea—about 1370 fathoms north of Flores, and 1700 fathoms, the maximum, a little east of Saleijer.—*Petermanns Mitt.*, No. 8.

This autumn the extension of the triangulation network of Italy with the **Maltese group**, first proposed by General A. Ferrero, will be executed under the direction of General Faini. The lighthouse of Guiridan on the island of Gozo has been chosen as the point to be observed from the mountains Cammarata and Tauro, in Sicily, from which it is distant 112 and 79 miles respectively.—*Rivista Geogr. Italiana*, July.

Mr. J. E. Moore, in command of the scientific expedition to the Central African lakes, has telegraphed to the Royal Geographical Society (*Journal*, Sept.) that the greatest depth he has sounded in **Lake Nyassa** is 430 fathoms. Lieut. Gurney's

soundings in 1896 showed that a considerable area in the northern half of the lake exceeded 300 fathoms in depth, the length of the wire carried in the gunboats, and great depths have been found at the extreme northern end, while the southern end is shallower.

Captain Wellby, after traversing the southern districts of Abyssinia, marched southwards to the eastern shore of Lake Rudolf. For a distance of thirty or forty miles east of the lake not a drop of water could be found. Passing Teleki's volcano (probably the new crater, three miles south of Teleki's, which, according to Mr. Cavendish, has disappeared), the expedition travelled westwards for 130 miles, and then turned northwards, keeping about half-way between Lake Rudolf and the Nile, and finally reached Nasser on the Sobat. The country consists of a succession of well-watered valleys and ranges of hills running north and south. A small river called Ruzi flows for a long distance northwards to join the Juba.—*Geogr. Journal*, Sept.

The **rainfall in Mysore** in 1898 was, as stated in the *Report* by the Director of Meteorology, Mr. John Cook, above the average of the past twenty-nine years, being 41·48 inches against an average of 36·85. The monthly distribution is shown by curves and maps, and a diagram also is given showing the rainfall of each district by a column, the breadth of which is in proportion to the area of the district, the excess above the average being coloured blue. Some observations were taken with Smith's Differential Forest Gauge, consisting of two bottles with areas as 2 to 1. This is intended to eliminate any loss due to evaporation in the case of gauges which can only be read at intervals. More records must be collected before the reliability of the instrument can be determined.

A German Colonial School, Wilhelmshof, has been established at Witzenhausen. The curriculum is planned to train up practical agriculturists, plantation managers, graziers, and merchants for the German colonies, and fit them for all kinds of occupation. Religious instruction will be added to guard the pupils from temptations that may beset them in foreign lands, and especially in the Tropics. The institution has a farm of nearly 340 acres, with orchards and vineyards, and a meteorological station has been erected in a large garden. Lectures are delivered, and instruction in mechanical crafts is imparted, in the mornings; the afternoons are devoted to work in field and garden, or to botanical, geological, and other excursions. The institution can receive thirty pupils, and has already fifteen.—*Geogr. Zeitschrift*, No. 8.

The **Vei**, dwelling on the confines of Sierra Leone and Liberia, are the only Negroes who possess a true and indigenous system of writing. The alphabet is syllabic, and is the only syllabic alphabet existing in Africa. Forbes, Norris, and Koelle wrote on this remarkable language in 1849 and 1854, and Forbes and Koelle asserted that the alphabet was invented about 1829 or 1839, but M. M. Delafosse in *L'Anthropologie*, vol. x., gives his opinion that it is at least two hundred years old; it is not certain that it was invented by the Vei themselves. Of the 226 characters, 25 resemble Berber consonants in form and 20 resemble European letters and numerals, but the sounds do not correspond, and M. Delafosse does not believe that the alphabet has been derived from these sources. Its use is increasing.—*Nature*, Aug. 24th.

The **Physical Atlas**, which has long been in course of preparation by Mr. J. G. Bartholomew, will consist of seven volumes, treating respectively of Geology, Orography, Hydrography and Oceanography, Meteorology, Botany, Zoology,

Ethnography and Demography, General Cosmography and Terrestrial Magnetism. Berghaus' Atlas has been used to a certain extent as the basis, but the present work is on a much more extensive scale, and will far surpass any similar work hitherto published. Leading specialists are giving their assistance in revising the sheets, and will contribute explanatory text.

The Meteorological section, comprising over four hundred maps on thirty-four plates will be issued shortly, and, in order to secure the reduction granted to Fellows of the Royal and Learned Societies, members should subscribe before October 15th.

Ekaterina, the new Russian harbour on the Murman coast, was opened on July 6th in the presence of the Grand Duke Vladimir. The town, the smallest in Europe, received the name of **Alexandrovsk**. The harbour lies in 69° 15′ N. lat. and 33° 30′ E. long. The works were commenced in 1896, and have been executed chiefly by Norwegian workmen under the supervision of a Norwegian engineer (*See* vol. xiii. p. 46). The foundation of this town and the removal of the seat of administration from Kola, where it was completely isolated from the neighbourhood during the winter months, to Alexandrovsk, must exercise a beneficial influence on the development of the Murman coast. The school of the new town will introduce regular education. There are also schools of navigation and shipbuilding, and a zoological station for the study of marine fauna, with which a fishery school is connected. The population of the Murman coast is 2000, but is increased in the season by thousands of fishermen. The Russian Government encourages settlement on this coast by granting loans and exemption from taxes. The climate is not extremely severe, owing to the influence of the Gulf Stream, which sends an arm to the coast, keeping the sea free of ice and rendering navigation possible throughout the year. In spring and autumn fog and rain are very prevalent, with a mean temperature of 37½°. In summer the mean temperature is 52°, and in winter 18½°. The thermometer seldom falls to 10° or zero.—*Geogr. Zeitschrift*, No. 8.

In order to provide a shorter route for goods brought by the Siberian railway to England and America than that through Germany, a railway has been planned from Stockholm north-eastward to Kapelskär, on the coast of Sweden, whence the Finnish coast is not far distant. Large steamers will carry goods across from Hangö, and eventually passengers. Moreover, a new line in Finland, 79 miles long, is to be constructed to the Swedish frontier by the autumn of 1902, which with the railway from Ofoten will complete the connection through the Siberian line between the Pacific and the Atlantic.—*Deutsche Rundschau*, Jahrg. xxi. Heft 12.

Another improvement in the communication between Siberia and Western Europe will be effected by a proposed line from Obdorsk on the Ob to Bielkovsk bay (Khaipudyrskaia?) south of Yugor Straits. The *Times* states that the Siberian railway has not rolling stock sufficient to transport bulky agricultural products, and therefore Siberian wheat often takes three or four months to reach the German markets, while the cost is heavy. The only alternative route at present is through the Kara Sea, and this is uncertain. By this railway 240 miles long, the voyage of about 1000 miles round the Yalmal peninsula would be avoided, and goods from the enormous basin of the Ob would be transported to a coast not so liable to be blocked in summer by ice as the Kara Sea and the Gulf of Ob. The Ob is free from ice at Barnaul for some 190 days in the year and at Obdursk for 146, so that the route would be open for about five months.

NEW BOOKS.

The Heart of Asia: a History of Russian Turkestan and the Central Asian Khanates from the Earliest Times. By Francis Henry Skrine, formerly of H.M. Indian Civil Service, and Edward Denison Ross, Ph.D., Professor of Persian at University College, London. Large crown 8vo. Pp. xi + 444. With Maps and many Illustrations. London: Methuen and Co., 1899. *Price* 10*s.* 6*d. net.*

The first half of this book (mostly from the pen of Dr. Ross) is a history of the territory forming the western division of Central Asia, now mostly comprised in the Russian provinces of Turkestan and Transcaspia (or more vaguely, Russian Turkestan). The narrative begins with the earliest times of which written records exist—the sixth century B.C., when the country is said to have been one of the satrapies of the empire founded by Cyrus the Persian. It ends with the year 1866 A.D., which saw the commencement of the final encounter between the Khanates of Bokhara and Khiva and the Russians. During these six-and-twenty centuries have come and gone in Turkestan divers tribes and peoples and tongues, Iranians, Greeks, Scythians, Turks and Tartars of various clans. The region has been the scene of conquest by, and contest between, many invading kings and armies—Pagan and Moslem, Aryan, Semitic, and Mongolian: of one abiding subjugation—that, namely, by Islam—but otherwise of changing dynasties and unstable thrones. The rise and fall of these are the prevailing feature of the narrative before us. Now and again a powerful ruler, followed by a dynasty longer or shorter lived, gave a measure of prosperity and civilisation to the distressful land. Yet it may be said that throughout the long period of 2600 years this region witnessed, perhaps as much as any similar inhabited space on the earth's surface, the transitoriness of human affairs. And it has perhaps as little to show as any similar region in the way of permanent human progress and achievement—intellectual, moral, or even material—attained within, or of enduring influence exerted upon human thought and action outside, its borders.

For this reason the narrative before us, compiled though it has been with much labour and care from many sources, is scarcely attractive reading. It contains in great measure dry bones of history—necessary, doubtless, to be laid bare and examined by historical research, but (except in the case of a very few personages such as Kutayba, Chenghiz, Timūr, and Bābar) not capable of being again made quick before the ordinary reader of this age.

The second half of the book, written mostly by Mr. Skrine and prompted apparently by a recent tour in Transcaspia and Turkestan, continues the history into what promises to be a new and happier era. The beginning of this era was not, indeed, unstained by lust of territory, aggression, and bloodshed—in one or two instances by ruthless carnage—which are said more than once to have stirred the conscience of the Emperor Alexander II. against the conduct of his agents. But Russian domination having been assured and consolidated, settled peace and civil order now reign and are likely long to reign in Turkestan under the sway of the Great White Czar. The natives, it is true, are not likely soon to forget that they are a conquered people under a foreign yoke, or to cease to cherish secret, but vain, hopes of regaining their lost independence. Russia wisely softens their loss by leaving to them a good deal of the management of their local and domestic concerns. But true to its general policy of russification—of distrusting and depressing in its subordinate nationalities institutions and traditions that seem inimical to its overshadowing autocracy—the Russian administration is certain to be in Turkestan watchful against existing influences of that kind and

to avoid the introduction of any influences capable of becoming so. Nevertheless, if not to our English eyes fully enlightened, Russian rule in Turkestan is on the whole mild and beneficent, as well as strong—vastly superior, materially and morally, to the preceding state of things. And it has attained its present state of progress in a marvellously short space of time.

This part of the book begins with a chapter sketching the origin and rise of the Russian Empire. In four succeeding chapters the history is described of the Russian advance into Asia, eastwards and southwards, until it reached its present line of halt abutting upon northern Persia, Afghanistan, and the mountain territories to the north-west of India. Next follows a chapter on central Asian railways. This is a subject worthy of the pages allotted to it. These railways are of the greatest strategic value, and they are becoming the highway of a rapidly developing commerce. It is no baseless vision, but a reasonable forecast, which anticipates the filling up, with a connecting line, of the gap of 450 miles across western and southern Afghanistan, between the railway terminus at Khusk on the Transcaspian frontier thirty miles north of Herat, and Chaman, the most advanced railway post on the western frontier of British India. In the final hundred pages of the book the authors give some account of the present condition of Transcaspia, Bokhara, and Samarkand, and of their chief places of interest; of the inhabitants and their customs and pursuits; lastly, of the Russian manner of governing in Turkestan, and of some of its administrators.

The whole of the second part of the book is in fact eminently readable and instructive. Contrasts between certain features in the Russian system of administration in Turkestan and the British system in India are made and suggested. These cannot be discussed here. The two systems differ, and could not well be other than they are, because the past history of the British people itself differs from Russia's. Which system is making the most and best of these subject eastern races only the distant future will show. For ourselves, we think that Great Britain need not fear the verdict of futurity. Meantime, we may follow with interest and without jealousy the civilising efforts of Russia.

It would be foolish to hazard predictions as to the further southward progress of Russia. The causes for her past advances set forth in Prince Gortschakoff's famous Circular have almost ceased to exist. For Russia is now confronted by "more solid and compact organisations" on her southern confines than were the roving Turkestan tribes and the fanatical Khanates. A diplomatic rupture with Persia, and causes of contention with England in other parts of the world, are more likely than merely local causes to precipitate a violation of the present frontier; and how or when these may come, who shall foretell? Great Britain can honestly say, and trust that Russia will believe, that she seeks no further extension of her Indian Empire. We, on the other hand, may hope, if do we not yet believe, that the governing class in Russia has also no similar aspirations. But it is only prudent to keep ourselves informed and to realise (as this book helps us to do) how that Power is, within its new frontier, preparing for forward movement should occasion arise.

History of the New World called America. By Edward John Payne. Vol. ii. Oxford: Clarendon Press, 1899. Pp. xxvii + 548. *Price* 14*s.*

After a lapse of seven years Mr. Payne has produced the second volume of his great work. It is unnecessary to enumerate the author's high qualifications for his important task, but it is pardonable to question again whether he has not underestimated the time and labour required for the fulfilment of his undertaking on the scale of the first and second volumes which have now appeared.

The present volume is characterised by all the evidence of deep research and ready power of drawing comparisons and applying wide knowledge which marked the first volume; and the interest is greater, since Mr. Payne has passed from the geographical to the ethnographical investigation of aboriginal America. The author strikes what is a leading note of his work when he says that early American history has interest and value not so much for the events to be chronicled and described as for the special illustration it affords of the transition from the natural or savage state to "the artificial state which we call civilisation." Mr. Payne's chief thesis is that early American development was indigenous, not external, in origin—the view of Mexicans and Peruvians themselves. The revelation of advanced modes and conditions of life among the native peoples suggested to inquirers shortly after the discovery that the civilisation thus disclosed was an imported old-world civilisation; and this assumption has continued to be generally made down to our own day, although undermined by the results of both the direct and the indirect method of inquiry pursued in recent years. The acceptance by Alexander von Humboldt of the theory of imported advancement gave to it both wide currency and a quasi-scientific or learned foundation; yet Humboldt, when he thus adopted the theory, had no such special knowledge as could enable him to write with authority. In a later work Humboldt adduced certain resemblances between the calendars of China and Mexico in proof of borrowed civilisation. Mr. Payne has undertaken to show fully and learnedly (and, we must also add, in not only technical but somewhat cumbrous language) that these alleged resemblances do not exist: the calendars have nothing in common: for example, "the Chinese calendar is not merely lunisolar, but exhibits the lunisolar reckoning in its most advanced form; the Mexican takes no account whatever of the moon, and shows no trace of the most rudimentary attempt at co-ordination of the day with the lunation, or of the lunation with the year"; or, again, "the Chinese have from early times possessed considerable knowledge of astronomy, and have applied it to an accurate division of the noctidiurnal period of twenty-four hours into twelve equal parts. The Mexicans were wholly ignorant of the rudiments of astronomy, and possessed no means whatever of dividing the day into equal parts."

Mr. Payne's investigation is comprehensive: it refers to rudimentary arithmetic, the beginnings of language and grammar, the growth of the industrial class, economical and social relations, and other elements of life, primitive and advancing, as presented by him for the elucidation of his subject. It will at once be surmised, therefore, that the worth of this volume is much higher than disputative or polemical: it seeks to do much more than to "drive from its last stronghold" the theory of imported early American advancement: it gives us the origin of American civilisation, is independent and critical, is wealthy in illustration, and has a broad intellectual sweep. Too many problems are raised and too many verdicts given on matters both essential and merely akin to the main inquiry for Mr. Payne to command undivided allegiance throughout the full scope of his investigation; but Mr. Payne does not dogmatise—he has the instincts of the scholar and the sympathies of the historian.

Austria. ("The Story of the Nations.") By SIDNEY WHITMAN, with the collaboration of J. R. M'ILRAITH. London: T. Fisher Unwin. Pp. xx + 407. With Map and Illustrations. *Price* 5*s.*

Mr. Sidney Whitman's *Realm of the Habsburgs*, published six years ago, consisted of a number of sketches of political and social life in Austria to-day.

The work before us is historical, not of an occasional or journalistic order. Mr. Whitman states that he had a choice of alternatives: he might either "treat of the principal historical events in proportion to their relative importance," or "give a succinct but unbroken record of the history of Austria as connected with the Imperial House." He would have preferred the former task; he has chosen the latter, partly in accordance with the scope and purpose of the series to which this volume belongs, partly owing to the absence "in any language" of a consecutive history of Austria. To us it seems that the author has misconstrued his task: the alternatives which he mentions are far from being mutually exclusive,—are not, in fact, alternatives at all, but are complementary and inseparable. An account—even a mere record—of the past of Austria cannot be written without a keen sense of proportion, the keener as space is the more restricted. Mr. Whitman has not kept proportion in the history of Austria itself, and, further, he does not reveal the wide issues of which the vicissitudes of "Austria"—not, in itself, a definite historical conception—are but part. For example, nowhere have we faithfully and clearly presented to us the meaning of the Mediæval Empire; later, we are not made to realise the significance to Austria of the rise and growth of Prussia in Frederick the Great's time, and in dealing with the eighteenth century the author lacks the grasp of international diplomacy and European issues, without which the place of Austria cannot be properly fixed. These are the broad faults of the work, which are sufficient to mar it, apart from minor defects, as a contribution to historical study even of a semi-popular character. The volume, however, passes over a long stretch of historical territory, touches on many important movements, and has incidental, if not continuous, interest. The map is not well designed. The illustrations are varied, and chosen with some judgment.

The Land of Goshen and the Exodus. By Major R. H. Brown, C.M.G., late Royal Engineers. London: E. Stanford, 1899. Pp. 85. *Price* 5*s.*

Major Brown does not pretend to be an Egyptologist, but having for some years inspected the Land of Goshen as Inspector-General of Irrigation in Lower Egypt, he is intimate with its topography. He accepts the route of the exodus suggested by M. Naville after the latter's identification in 1883 of Tel el Maskhuta (or "the mound of the image") with the site of the treasure-city named in Exodus i. 11. Pithom or Pi Tum—the abode of the god Tum, situated about fifteen miles west of Ismailia. Further, in 1885, M. Naville identified Saft el Henneh, a village between Zagazig and Tel el Kebir, as the site of Pi-Sopt (the abode of the god Sopt), which was the religious capital of the 20th or Arabian nome of Lower Egypt. Pithom and Sopt were cities of Gesem or Goshen, a pastoral district then watered by a branch of the Nile. The court of Pharaoh, where Joseph was, is assumed to have been at Bubastis, the modern Tel el Basta (Zagazig), and the author, following M. Naville, adopts as the line of the exodus a route passing Tel el Kebir, Kassassin, Tel el Maskhuta (Pithom), Heroöpolis (Ero), and turning south-eastwards past Serapeum, and crossing a spot now occupied by the Suez Canal (but at the time of the exodus by an arm of the Red Sea) to Baalzephon. As this route is given in the *Atlas of the Egypt Exploration Fund* (2nd edition, revised 1894) with a summary of M. Naville's discoveries, the author has contributed nothing new on the subject, but his book is interesting as a clear and popular scientific account of the exodus, and is illustrated with photographs of the mummies of the Pharaohs Seti I., and Ramses the Great. He reminds us that the route by which the Israelites escaped from the bondage of Egypt, *circa* B.C.

1277, was not dissimilar from that by which the British army entered Egypt in 1882 and delivered the country "from the bondage of misrule and oppression."

History of Baalbek. By Michel M. Aloof. Translated by L. Moonyaart. 6th Edition. Beirut (Syria): Imp. des Belles Lettres, 1898. Pp. 144.

"Baalbek is seen like a queen luxuriously seated on a verdant throne, on one side Anti-Libanus and on the other the Plain. Further, on the right, the lofty summit of Mount Hermon stands out from the Anti-Libanus on an azure-blue background." The cedars of Lebanon (of which five forests still remain) cover the mountains, whilst the sea forms the horizon. Baalbek signifies the "town of the solar divinity" *Baal*, and was called Heliopolis by the Romans. The author states that the Temple of the Sun here is much older than the Pharaohs (who only restored it when monarchs of Syria), but as, according to Von Oppenheim (*rev.* p. 440), he is wrong in identifying "Tadmor" with Palmyra, it may be questioned whether "Baalath" (1 Kings ix. 18) is Baalbek. The author, however, holds that Solomon built a magnificent temple here in honour of Baal in order to please his concubines, and that this harmonises perfectly with the popular tradition that Solomon had a splendid castle built at Baalbek, which he gave as a present to Balkis the Queen of Sheba. This little book is a complete and scholarly account of an extremely interesting city, and is nicely illustrated.

Three Pleasant Springs in Portugal. By Commander the Hon. Henry N. Shore, R.N. London: Sampson Low, Marston, and Company, 1899. *Price* 12*s.* 6*d.*

In this volume Commander Shore, of the Royal Navy, describes to us three excursions which he, accompanied by his wife, made into the more unknown tracts of Portugal in the north, the centre, and the south. He has the eye of an artist for the picturesque aspects of Nature, and is gifted with an eloquent and graphic style of description, so that the reader quickly has a clear comprehension of what he is to see and undergo, if he devotes some months to the exploration of Portugal. Besides this, the Commander is well versed in the literature which illustrates his subject, and makes most judicious and entertaining use of his materials; any one who thinks of visiting Portugal could not do better than read up the books he recommends, which we need hardly say are not the ordinary guide-books. Travelling in Portugal, it must be confessed, is a very different thing from travelling in Italy or Switzerland, and the traveller must be prepared to rough it in a way for a description of which we must refer him to these pages. Although detesting the English as a nation, the Portuguese are courteous and even kind to individual English travellers who are content to take them as they are and who do not expect all "the comforts of the Sautmarket" when so far away from home. Dilatoriness, or more accurately, dawdling, seems to be the distinguishing feature of Portuguese travelling and life. Twenty miles an hour is a very unusual speed for an express train, and on most lines there seems to be only one express train in the twenty-four hours. There are few, if any, good roads for driving purposes. The accommodation in the so-called hotels is primitive and scanty, while the food, though plentiful, is prepared in a way that will try even an experienced and seasoned votary of Cook. Still, notwithstanding many inconveniences, the Commander and his wife seem to have enjoyed their sojourn in Portugal very much, and to have brought away many pleasant recollections of the country and the people, not to speak of a curious collection of quaint pottery.

Birkhill. A Reminiscence by a Liverpool Merchant. Selkirk: James Lewis, 1899. Pp. 95. *Price* 3*s.* 6*d.*

Birkhill is situated between Moffat and St. Mary's Loch, and forms a convenient centre from which the author describes Moffatdale, Loch Skene (here spelt Skeen), the Grey Mare's Tail, Cramalt Burn, Meggat, Gameshope, Tushielaw Tower and Ettrick, Newark Castle, Yarrow, and St. Mary's Loch, with the aid of illustrations which are said to be from original sketches, but which might have been from photographs.

The Tides and Kindred Phenomena in the Solar System. By GEORGE HOWARD DARWIN. Boston and New York: Houghton, Mifflin, and Co., 1898. Pp. 378.

Professor George Darwin was Lowell lecturer in Boston in 1897, and took as his subject "Tides and Kindred Phenomena." Believing that mathematical argument is organised common-sense and should be capable of exposition to those unskilled in mathematical notations, he has attempted to do this for tidal phenomena, and he has done it well.

Tide-gauges, seiches, bores, tide-mills, and a historical account of theories of the tides, occupy the first four chapters.

Special attention may be called to Chapter v. on the tide-generating force, wherein the effects of the centrifugal and centripetal forces of two bodies, such as the Earth and Moon, revolving round a common centre of gravity, and both bodies supposed to be non-rotating, are worked out. This way of studying tidal action, the author notes, is due to Professor William Morris Davis of Harvard University.

Chapter vi. tells of experiments with a bifilar pendulum to measure the deflection from the vertical due to the tides, and reveals the great ingenuity of Prof. Darwin and his brother Horace. The pendulum could show movements of one-millionth of an inch, one two-hundredth of a second of arc, or the angle subtended at 770 miles by one inch. It was found that a very slight shifting in position of a person—for instance, the transference of his weight from one foot to the other—so altered the ground that the pendulum recorded the change of warping. "The dimple produced by a weight of 140 lbs. on the stone-paved floor must have been pretty small, and the slope of the sides of that dimple at sixteen feet must have been excessively slight, but we were here virtually observing the change of slope at the instrument, when the centre of the dimple was removed from a distance of fifteen to sixteen feet." So many earth tremors are recorded by this instrument that the tidal effects it was designed to measure cannot be distinguished. Readers may be referred to Professor Milne's *Seismology* for a further account of this interesting subject.

The tidal changes cause warpings of the land, and even the effects of atmospheric pressure are such that we are probably "at least three inches nearer the earth's centre" when the barometer is very high than when it is very low, and the sea would be depressed twenty-seven inches, or twenty-four inches with reference to the depressed land, under a high atmospheric pressure.

In Chapter viii. the equilibrium theory of the tides is developed, and in Chapter ix. the dynamical one. Whewell's sixty-year-old cotidal chart is reproduced in Chapter ix., but it is a pity that Professor Darwin rested satisfied with it. A cotidal map based on observation is one of the most important documents that could be compiled for the student of physical geography at the present day.

Chapter xi. deals with the harmonic analysis of tides, xii. with the reduction

of tidal observations, XIII. with tide tables, and XIV. with the degree of accuracy of tidal predictions.

The concluding chapters discuss the general problems, such as variations of latitude, tidal friction, the evolution of celestial systems and Saturn's rings.

The book, both in its practical and theoretical chapters, is eminently readable, and is characterised by Darwinian directness, simplicity, and lucidity. It is a work which satisfactorily meets a long-felt want.

Traité Elémentaire de Météorologie. Par Dr. ANGOT. Paris: Gauthier-Villars, 1899. Pp. vi + 417. *Price* 12 *frcs.*

We are glad to be able to offer a warm welcome to this excellent work, which certainly merits a more exalted designation than "Elementary." With wise discrimination the author has avoided the plethora of details regarding instruments, which not infrequently in works of this class monopolises space which could be devoted to much better purpose. The work is divided into five sections, each of which is extremely well balanced, and founded on the best available sources. The author opens with a dissertation on temperature, more especially with reference to its distribution over the land and water surfaces of the globe; and among other subjects equally fully treated are pressure, storms, weather forecasting, and optical and electrical phenomena. One of the most interesting chapters is that which deals with the normal tracks of depressions and cyclones over the Atlantic and other oceans, but the author, along with most meteorologists, shirks the intricate problem of weather abnormalities, more particularly in their secular variations. The book is printed in excellent type on very good paper, and is freely illustrated with charming engravings and photographic reproductions of cloud forms and other atmospheric phenomena. We trust that it will not be long before an English translation is in the hands of the public.

On the Laws of Movement of Sea Currents and Rivers. By A. W. CRONANDER, Ph.D. Norrköpings: Tidningars Aktiebolag, 1898. Pp. 57. With five Appendices of Tables and five Plates.

This is the discussion of a laborious piece of work in connection with the currents in and out of the Baltic Ocean. The observations of these currents in the Cattegat, the Sound, and the Great Belt cannot but be of the greatest importance in the study of the origin of ocean currents. The whole region is particularly well suited for hydrographical research of this kind, for the district is well supplied with meteorological stations, and the outlets are narrow and well defined. One great object was to establish a correspondence between the winds and the currents. This Dr. Cronander has effectively done, and one of his most important conclusions is that easterly winds in the Baltic and outgoing currents coincide, as do also westerly winds in the North Sea and ingoing currents in the Belt and Sound. Since, however, the successive water-layers at different depths move as in rivers and not as in drift currents on the sea, the conclusion is that the direct cause of the currents is not the wind itself, but the difference of level caused by the wind. The author doubts the existence of a connection between saltness and sea-currents in the Baltic district; he admits, however, that the balance of the movement of the water masses is outwards, owing to the fresh water poured into the Baltic by rivers. It seems equally certain that, when Atlantic water enters the Kattegat (as it does), the surface water must be raised and an outward current produced, which may, indeed, be temporarily reversed by the action of the wind.

Die Elemente des Erdmagnetismus für die Epochen 1600, 1650, 1700, 1780, 1840, 1885, *und ihre saecularen Aenderungen, etc., etc.* By Dr. H. Fritsche. St. Petersburg, 1899. 112 pages.

This lithographed pamphlet contains the terrestrial magnetic elements for the epochs named in the title, and their secular variations calculated, in accordance with Gauss's general theory of terrestrial magnetism, with the help of a new set of coefficients deduced from all good existing observations. It may be regarded as an appendix to Dr. Fritsche's work of 1897 on the determination of the Gaussian coefficients for the epoch 1885, and is an extremely valuable contribution to this difficult subject. One important feature is that, instead of being content with the twenty-four coefficients deemed sufficient by Gauss, the author calculates forty-six coefficients, and obtains a correspondingly more accurate representation of the functions involved. The formulæ used in the reductions and calculations are given in the first ten or twelve pages; and the rest of the pamphlet consists chiefly of tables of numbers, the values of each element at each epoch being given for every 10° latitude and 15° longitude. Curves are also given showing the secular variation of the declination at thirty-six different localities. In the concluding paragraph Dr. Fritsche suggests as a possible cause of the secular variation in the terrestrial magnetic elements the changes in the distribution of heat throughout the earth. We should like to see this pamphlet, which embodies laborious and intricate calculations, printed in good clear type, and supplemented by charts comparing broadly the condition of things at the different epochs.

Album Géographique. Par MM. Marcel Dubois, professeur de géographie coloniale à la Faculté des Lettres de Paris, et Camille Guy, Chef du Service géographique au Ministère des Colonies. Tome iii. *Les Régions tempérées.* Paris: Armand Colin et Cie., 1899. *Price* 15 *fr.*

The third volume of this admirable collection of pictures of geographical interest deals with the temperate regions. Those for each country are prefaced by a brief review of its salient features. Eight to twelve explanatory lines accompany each picture, but these have not the precision of a *Figaro* pen portrait. At the foot of a view of Ben Nevis we find no reference to Ben Nevis, but the statement:—"Certains sommets, tels que le Ben Atow, sont couverts de neige et de glaciers"!

Colwyn is a seaside town of the plains; the Caledonian Canal lies in the "borderlands" where the free Scot struggled for centuries with the conquering Saxon; the Thames rises a few kilometers from the *source* of the Severn—such are some of the statements on the first few pages which, along with a number of misprints, *e.g.* 'Royal Mai Coach en Islande' *for* Royal Mail Coach en Irlande, should not have been passed by the editors.

The collection of pictures, however, is good and instructive; and the book is one eminently suitable for either the school or the home library.

The Queen's Empire. A Pictorial and Descriptive Record illustrated from Photographs. Second volume. London: Cassell and Co., 1899. *Price* 9*s.*

The general plan of this work was described when the first volume was noticed (vol. xiv. p. 446). A few of the headings in the second volume are: "The Trade of the Empire," "The Capitals and Chief Cities of the Empire," "The Natural Scenery of the Empire," "The Navy," "The Army." The photographs have been well chosen, and as a rule the reproduction is excellent.

La Colonisation Française en Annam et au Tonkin. Par Joleaud-Barral. Paris: E. Plon Nourrit et Cie., 1899. Pp. 248. *Price* 4 *francs.*

French colonisation is a tender plant, and we do not know that it will be strengthened by fault-finding, such as occurs in this and similar books by "candid friends." M. Barral declares that Frenchmen are driven from their own colonies by the fiscal exactions of their own Government officials. Rather contradictorily to this, however, he represents Hanoi, the French metropolis of Tonkin, as a most vigorous and progressive centre. "At Singapore and Saigon people exist, at Hanoi they *live.* Yes, life is very fast there. Hanoi is not one of those restful provincial cities. It increases with surprising rapidity. It is in a feverish state of prosperity." The book is illustrated with numerous interesting phototype pictures and three maps.

Mexiko. Skizzen und Typen aus dem Italien der Neuen Welt von Ernst Below. Zweite Auflage. Berlin: Allgemeiner Verein für Deutsche Litteratur, 1899. Pp. xvii + 362.

The author practised as a doctor thirteen years in Mexico, soon after Porfirio Diaz became president, and relates some of his experiences in this book. Each chapter contains a sketch of a particular excursion or incident, one of the most interesting being the account of an ascent of Popocatepetl; and the collection as a whole is very readable. In the preface Dr. Below indulges in a good deal of "tall talk"; the Germans are to be the masters of the world, and under them altruism is to thrust out conquest by force of arms and the Anglo-Saxon mammon-worship. The real attitude of the Germans in Mexico, as the author portrays it, is briefly summed up in his own lines:

> "Was thun wir Deutschen nicht fürs Geld
> Wir sind die Juden der neuen Welt."

Many changes have taken place in Mexico since Dr. Below lived there, and the morality of the German trading community is probably improved.

Impressions of America. By T. C. Porter. Illustrated with Diagrams and Stereoscopic Views. London: C. Arthur Pearson, Limited, 1899. *Price* 10*s.* 6*d.*

The writer of this volume tells us that it was the chance word of a fellow-passenger which decided him to publish this work; and he trusts that it may stimulate interest both in America and Europe in the magnificent and wonderful scenery which he describes. The tracts of America which he visited are well known, viz., Niagara, the Yellowstone Park, the Yosemite Valley, and Colorado, all of which have been repeatedly described by other writers, we might even say *ad nauseam*, but it is only fair to Mr. Porter to state that, thanks to his picturesque descriptions, his careful observation, his pleasant and easy style, and his enthusiasm, the reader does not weary of a well-worn subject, and we found the *Impressions of America* an excellent book for a hot summer day. The principal feature of the book is the illustrations, to view which a portable stereoscope is placed in an envelope at the end, and in the preface there are elaborate directions how this stereoscope is to be used, and also how the reader may dispense with its services entirely. So far as we are aware, this is the first British publication in which a portable stereoscope has ever been supplied to the reader, and we can vouch from personal experience that its use is a very great improvement to the illustrations.

British Rainfall, 1898. Compiled by G. J. Symons, F.R.S., and H. Sowerby Wallis. London: Edward Stanford, 1899. Pp. 68+[251]. *Price* 10*s.*

As in last year's volume, there are in the present one, besides the usual tables of rainfall, several notes and articles on meteorological subjects. Self-recording rain-gauges are described, the increase of rain with altitude above sea-level, and a great thunderstorm at Angerton are discussed. Tables showing the evaporation at Camden Square, 1885-98, at Croydon, and at Lowestoft, are also given, and phenomena connected with the rainfall of 1898 are noticed.

Britain on and beyond the Sea. By Cecil H. Crofts, M.A. Edinburgh and London: W. and A. K. Johnston, n.d.

This little book is intended to accompany the Navy League Map of the World. It contains a sketch of naval battles fought by British fleets and a list of British possessions, with a few notes on their political status.

A Handbook for Travellers in Japan. By Basil Hall Chamberlain, F.R.G.S., and W. B. Mason, Corr. Member of the Royal Scottish Geographical Society. Fifth edition. London: John Murray, 1899. Pp. 577. *Price* 20*s.*

The new edition has been thoroughly revised, many of the less frequented districts having been revisited by the compilers. An important addition are chapters on the Luchu Islands and Formosa, now annexed by Japan.

A Guide to Chamonix and the Range of Mont Blanc. A Guide to Zermatt and the Matterhorn. By Edward Whymper. *Price* 3*s. net, each.*

As the last editions of these guides were issued in 1898 (see vol. xiv. p. 504) there are no great alterations in the present. A few notes on the most recent changes and events are all that have been found necessary.

The Eastern Alps, including the Bavarian Highlands, Tyrol, etc. Handbook for Travellers by Karl Baedeker. Leipsic: Karl Baedeker, 1899. Pp. xxvi +468. *Price* 10 *marks.*

The last edition, the eighth, appeared in 1895, and as tourists are flocking in larger numbers to the east of Switzerland and the adjoining Alpine countries, a revision is necessary. New routes are described, and several maps are added. A chapter in the introduction contains instructions for cyclists.

The "Way About" Series of Gazetteer Guides. No. 11. *The Way about South Wales*, by J. C. Manning. No. 17. *The Way about Ireland*, by J. O'Neill Lane. No. 22. *The Way about the Irish Lakes and Rivers*, by J. O'Neill Lane. No. 23. *The Way about Yorkshire*, by R. T. Lang. London: Iliffe, Sons, and Sturmey, n.d. *Price* 1*s. each.*

These guides are much condensed, as may be expected, seeing that South Wales, for instance, is described in a small book of 158 pages (excluding gazetteer and index). Only a few lines are devoted to such places as Aberystwith and Abergavenny. The various routes are detailed, but in a "Way About" guide one would expect more information regarding carriages, railways, hotels, etc. The small form and price, however, must be considered, and the test of these volumes should be their accuracy; we have not detected any misstatements.

NEW MAPS.

EUROPE.

PLYMOUTH AND DEVONPORT, Plan of ——. By J. Bartholomew, F.R.G.S. *Price* 2*s.* *W. H. Smith and Sons, London.*

GLASGOW DISTRICT, Road Map of ——. Two miles to an inch. *Price* 1*s.* *J. Bartholomew and Co., Edinburgh.*

RUSSIE D'EUROPE. Atlas Universel de Géographie, ouvrage commencé par M. Vivien de Saint-Martin et continué par Fr. Schrader. No. 37. *Hachette and Co., London.*

FORMA URBIS ROMÆ. Formam dimensus est et ad modulum 1 : 1000 delineavit Rodolphus Lanciani, Romanus. Fasciculus septimus. *Presented by Mrs. Hugh Rose.*

ASIA.

KLEINASIEN, Archaologische Karte von ——, bearbeitet von Dr. W. Ruge und Dr. E. Friedrich. Massstab 1 : 2,500,000. *Preis* 3 *M.* *Verlag von G. Sternkopf, Halle a. S.*

The general map of Asia Minor noticed on p. 280 forms the basis of the present map. A large number of ancient names are marked in red, those which have been identified with certainty being distinguished by thicker type ; and the modern names are printed in black. An inset on a larger scale shows the plain of Troy. The map is an extremely useful one to students.

AFRICA.

SOUTH AFRICAN REPUBLIC (TRANSVAAL), Map of the ——. Scale 1 : 1,000,000, or 16 miles to an inch. *Edward Stanford, London.*

SOUTH AFRICAN REPUBLIC, Map of the Transvaal or ——, and surrounding countries. *Price, paper* 1*s.* ; *on cloth*, 2*s.* *W. and A. K. Johnston, Edinburgh.*

The former of these sheets represents the Transvaal with the adjoining parts of the Orange Free State, Rhodesia, Natal, and Portuguese East Africa. It is a well-executed map, showing the hydrographical system thoroughly, and containing a large number of names. The latter sheet is especially intended to illustrate the present Transvaal question, and, besides the main map, contains several insets—a general map of South Africa, Cape Town, environs of Johannesburg, etc.

AFRIQUE FRANÇAISE. Atlas Universel de Géographie. No. 42 ter. *Hachette and Co., London.*

AUSTRALIA.

QUEENSLAND, Geological Map of ——. Compiled by Robert L. Jack, F.G.S., F.R.G.S., Government Geologist. 1899. Scale 1 : 1,013,760, or 16 miles to an inch. 6 sheets.

CHARTERS TOWERS GOLDFIELD, Map of ——. Geological lines by R. L. Jack and A. Gibson Maitland. Scale 4 chains to an inch. 6 sheets. 1898. *Presented by the Queensland representative, Greater Britain Exhibition.*

Mr. Jack, with the aid of his assistants, and by carefully collecting the observations of a large number of authorities, has compiled a geological map of the colony far more complete than the edition of 1892. In some parts new outcrops have been discovered, and in others specialisation has been carried further. The outcrop of the Blythesdale Braystone, so important as a source of water supply, is here defined.

30
20
PEAKE
DEEP
MONACO
DEEP
CHUN
DEEP

SHOWING THE "DEEPS" ACCORDING TO SIR JOHN MURRAY

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

ADDRESS TO THE GEOLOGICAL SECTION OF THE BRITISH ASSOCIATION, 1899.

By Sir Archibald Geikie, D.C.L., D.Sc., F.R.S., President of the Section.

Among the many questions of great theoretical importance which have engaged the attention of geologists, none has in late years awakened more interest or aroused livelier controversy than that which deals with Time as an element in geological history. The various schools which have successively arisen—Cataclysmal, Uniformitarian, and Evolutionist—have had each its own views as to the duration of their chronology, as well as to the operations of terrestrial energy. But though holding different opinions, they did not make these differences matter of special controversy among themselves. About thirty years ago, however, they were startled by a bold irruption into their camp from the side of physics. They were then called on to reform their ways, which were declared to be flatly opposed to the teachings of natural philosophy. Since that period the discussion then started regarding the age of the Earth and the value of geological time has continued with varying animation. Evidence of the most multifarious kind has been brought forward, and arguments of widely different degrees of validity have been pressed into service both by geologists and palæontologists on one side, and by physicists on the other. For the last year or two there has been a pause in the controversy, though no general agreement has been arrived at in regard to the matters in dispute. The present interval of comparative quietude seems favourable for a dispassionate review of the debate. I propose, therefore, to take, as perhaps a not inappropriate subject on which to address geologists upon a somewhat international occasion like this present meeting of the British Association at Dover, the question of

Geological Time. In offering a brief history of the discussion, I gladly avail myself of the opportunity of enforcing one of the lessons which the discussion has impressed upon my own mind, and to point a moral which, as it seems to me, we geologists may take home to ourselves from a consideration of the whole question. There is, I think, a practical outcome which may be made to issue from the controversy in a combination of sympathy and co-operation among geologists all over the world. A lasting service will be rendered to our science if by well-concerted effort we can place geological dynamics and geological chronology on a broader and firmer basis of actual experiment and measurement than has yet been laid.

To understand aright the origin and progress of the dispute regarding the value of time in geological speculation, we must take note of the attitude maintained towards this subject by some of the early fathers of the science. Among these pioneers none has left his mark more deeply graven on the foundations of modern geology than James Hutton. To him, more than to any other writer of his day, do we owe the doctrine of the high antiquity of our globe. No one before him had ever seen so clearly the abundant and impressive proofs of this remote antiquity recorded in the rocks of the earth's crust. In these rocks he traced the operation of the same slow and quiet processes which he observed to be at work at present in gradually transforming the face of the existing continents. When he stood face to face with the proofs of decay among the mountains, there seems to have arisen uppermost in his mind the thought of the immense succession of ages which these proofs revealed to him. His observant eye enabled him to see "the operations of the surface wasting the solid body of the globe, and to read the unmeasurable course of time that must have flowed during those amazing operations, which the vulgar do not see, and which the learned seem to see without wonder."[1] In contemplating the stupendous results achieved by such apparently feeble forces, Hutton felt that one great objection he had to contend with in the reception of his theory, even by the scientific men of his day, lay in the inability or unwillingness of the human mind to admit such large demands as he made on the past. "What more can we require?" he asks in summing up his conclusions; and he answers the question in these memorable words: "What more can we require? Nothing but time. It is not any part of the process that will be disputed; but after allowing all the parts, the whole will be denied; and for what?—only because we are not disposed to allow that quantity of time which the ablution of so much wasted mountain might require."[2]

Far as Hutton could follow the succession of events registered in the rocky crust of the globe, he found himself baffled by the closing in around him of that dark abysm of time into which neither eye nor imagination seemed able to penetrate. He well knew that, behind and beyond the ages recorded in the oldest of the primitive rocks, there must have stretched a vast earlier time, of which no record met his view. He did not attempt to speculate beyond the limits of his evidence. "I do not

[1] *Theory of the Earth*, vol. i. p. 108.

[2] *Op. cit.* vol. ii. p. 329.

pretend," he said, "to describe the beginning of things; I take things such as I find them at present, and from these I reason with regard to that which must have been."[1] In vain could he look, even among the oldest formations, for any sign of the infancy of the planet. He could only detect a repeated series of similar revolutions, the oldest of which was assuredly not the first in the terrestrial history, and he concluded, as "the result of this physical inquiry, that we find no vestige of a beginning, no prospect of an end."[2]

This conclusion from strictly geological evidence has been impugned from the side of physics, and, as further developed by Playfair, has been declared to be contradicted by the principles of natural philosophy. But if it be considered on the basis of the evidence on which it was originally propounded, it was absolutely true in Hutton's time and remains true to-day. That able reasoner never claimed that the earth has existed from all eternity, or that it will go on existing for ever. He admitted that it must have had a beginning, but he had been unable to find any vestige of that beginning in the structure of the planet itself. And notwithstanding all the multiplied researches of the century that has passed since the immortal *Theory of the Earth* was published, no relic of the first condition of our earth has been found. We have speculated much, indeed, on the subject, and our friends the physicists have speculated still more. Some of the speculations do not seem to me more philosophical than many of those of the older cosmogonists. As far as reliable evidence can be drawn from the rocks of the globe itself, we do not seem to be nearer the discovery of the beginning than Hutton was. The most ancient rocks that can be reached are demonstrably not the first-formed of all. They were preceded by others which we know must have existed, though no vestige of them may remain.

It may be further asserted that, while it was Hutton who first impressed on modern geology the conviction that for the adequate comprehension of the past history of the earth vast periods of time must be admitted to have elapsed, our debt of obligation to him is increased by the genius with which he linked the passage of these vast periods with the present economy of nature. He first realised the influence of time as a factor in geological dynamics, and first taught the efficacy of the quiet and unobtrusive forces of nature. His predecessors and contemporaries were never tired of invoking the more vigorous manifestations of terrestrial energy. They saw in the composition of the land and in the structure of mountains and valleys memorials of numberless convulsions and cataclysms. In Hutton's philosophy, however, "it is the little causes, long continued, which are considered as bringing about the greatest changes of the earth."[3]

And yet, unlike many of those who derived their inspiration from his teaching, but pushed his tenets to extremes which he doubtless never anticipated, he did not look upon time as a kind of scientific fetich, the invocation of which would endow with efficacy even the most trifling

[1] *Op. cit.* vol. i. p. 173 *note.*

[2] *Op. cit.* vol. i. p. 200.

[3] *Theory of the Earth*, vol. ii. p. 205.

phenomena. As if he had foreseen the use that might be made of his doctrine, he uttered this remarkable warning: "With regard to the effect of time, though the continuance of time may do much in those operations which are extremely slow, where no change, to our observation, has appeared to take place, yet, where it is not in the nature of things to produce the change in question, the unlimited course of time would be no more effectual than the moment by which we measure events in our observations."[1]

We thus see that in the philosophy of Hutton, out of which so much of modern geology has been developed, the vastness of the antiquity of the globe was deduced from the structure of the terrestrial crust and the slow rate of action of the forces by which the surface of the crust is observed to be modified. But no attempt was made by him to measure that antiquity by any of the chronological standards of human contrivance. He was content to realise for himself and to impress upon others that the history of the earth could not be understood, save by the admission that it occupied prolonged though indeterminate ages in its accomplishment. And assuredly no part of his teaching has been more amply sustained by the subsequent progress of research.

Playfair, from whose admirable *Illustrations of the Huttonian Theory* most geologists have derived all that they know directly of that theory, went a little further than his friend and master in dealing with the age of the earth. Not restricting himself, as Hutton did, to the testimony of the rocks, which showed neither vestige of a beginning nor prospect of an end, he called in the evidence of the cosmos outside the limits of our planet, and declared that in the firmament also no mark could be discovered of the commencement or termination of the present order, no symptom of infancy or old age, nor any sign by which the future or past duration of the universe might be estimated.[2] He thus advanced beyond the strictly geological basis of reasoning, and committed himself to statements which, like some made also by Hutton, seem to have been suggested by certain deductions of the French mathematicians of his day regarding the stability of the planetary motions. His statements have been disproved by modern physics; distinct evidence, both from the earth and the cosmos, has been brought forward of progress from a beginning which can be conceived, through successive stages to an end which can be foreseen. But the disproof leaves Hutton's doctrine about the vastness of geological time exactly where it was. Surely it was no abuse of language to speak of periods as being vast, which can only be expressed in millions of years.

It is easy to understand how the Uniformitarian school, which sprang from the teaching of Hutton and Playfair, came to believe that the whole of eternity was at the disposal of geologists. In popular estimation, as the ancient science of astronomy was that of infinite distance, so the modern study of geology was the science of infinite time. It must be frankly conceded that geologists, believing themselves unfettered by any limits to their chronology, made ample use of their imagined liberty.

[1] *Op. cit.* vol. i. p. 44.

[2] *Illustrations of the Huttonian Theory*, § 118.

Many of them, following the lead of Lyell, to whose writings in other respects modern geology owes so deep a debt of gratitude, became utterly reckless in their demands for time, demands which even the requirements of their own science, if they had adequately realised them, did not warrant. The older geologists had not attempted to express their vast periods in terms of years. The indefiniteness of their language fitly denoted the absence of any ascertainable limits to the successive ages with which they had to deal. And until some evidence should be discovered whereby these limits might be fixed and measured by human standards, no reproach could justly be brought against the geological terminology. It was far more philosophical to be content, in the meanwhile, with indeterminate expressions, than from data of the weakest or most speculative kind to attempt to measure geological periods by a chronology of years or centuries.

In the year 1862 a wholly new light was thrown on the question of the age of our globe and the duration of geological time by the remarkable paper on the Secular Cooling of the Earth communicated by Lord Kelvin (then Sir William Thomson) to the Royal Society of Edinburgh.[1] In this memoir he first developed his now well-known argument from the observed rate of increase of temperature downwards from the surface of the land. He astonished geologists by announcing to them that some definite limits to the age of our planet might be ascertained, and by declaring his belief that this age must be more than 20 millions, but less than 400 millions of years.

Nearly four years later he emphasised his dissent from what he considered to be the current geological opinions of the day by repeating the same argument in a more pointedly antagonistic form in a paper of only a few sentences, entitled, "The Doctrine of Uniformity in Geology briefly refuted."[2]

Again, after a further lapse of about two years, when, as President of the Geological Society of Glasgow, it became his duty to give an address, he returned to the same topic and arraigned more boldly and explicitly than ever the geology of the time. He then declared that "a great reform in geological speculation seems now to have become necessary," and he went so far as to affirm that "it is quite certain that a great mistake has been made—that British popular geology at the present time is in direct opposition to the principles of natural philosophy."[3] In pressing once more the original argument derived from the downward increase of terrestrial temperature, he now reinforced it by two further arguments, the one based on the retardation of the earth's angular velocity by tidal friction, the other on the limitation of the age of the sun.

These three lines of attack remain still those along which the assault from physics is delivered against the strongholds of geology. Lord Kelvin has repeatedly returned to the charge since 1868, his latest contribution to the controversy having been pronounced two years

[1] *Trans. Roy. Soc. Edin.*, vol. xxiii. (1862).

[2] *Proc. Roy. Soc. Edin.*, vol. v. p. 512 (Dec. 18, 1865).

[3] *Trans. Geol. Soc. Glasgow*, vol. iii. (February 1868), pp. 1, 16.

ago.[1] While his physical arguments remain the same, the limits of time which he deduces from them have been successively diminished. The original maximum of 400 millions of years has now been restricted by him to not much more than 20 millions, while Professor Tait grudgingly allows something less than 10 millions.[2]

Soon after the appearance of Lord Kelvin's indictment of modern geology in 1868, the defence of the science was taken up by Huxley, who happened at the time to be President of the Geological Society of London. In his own inimitably brilliant way, half seriously, half playfully, this doughty combatant, with evident relish, tossed the physical arguments to and fro in the eyes of his geological brethren, as a barrister may flourish his brief before a sympathetic jury. He was willing to admit that "the rapidity of rotation of the earth *may* be diminishing, that the sun *may* be waxing dim, or that the earth itself *may* be cooling." But he went on to add his suspicion that "most of us are Gallios, 'who care for none of these things,' being of opinion that, true or fictitious, they have made no practical difference to the earth, during the period of which a record is preserved in stratified deposits."[3]

For the indifference which their advocate thus professed on their behalf most geologists believed that they had ample justification. The limits within which the physicist would circumscribe the earth's history were so vague, yet so vast, that whether the time allowed were 400 millions or 100 millions of years did not seem to them greatly to matter. After all, it was not the time that chiefly interested them, but the grand succession of events which the time had witnessed. That succession had been established on observations so abundant and so precise that it could withstand attack from any quarter, and it had taken as firm and lasting a place among the solid achievements of science as could be claimed for any physical speculations whatsoever. Whether the time required for the transaction of this marvellous earth-history was some millions of years more or some millions of years less did not seem to the geologists to be a question on which their science stood in antagonism with the principles of natural philosophy, but one which the natural philosophers might be left to settle at their own good pleasure.

For myself, I may be permitted here to say that I have never shared this feeling of indifference and unconcern. As far back as the year 1868, only a month after Lord Kelvin's first presentation of his threefold argument in favour of limiting the age of the earth, I gave in my adhesion to the propriety of restricting the geological demands for time. I then showed that even the phenomena of denudation, which, from the time of Hutton downwards, had been most constantly and confidently appealed to in support of the inconceivably vast antiquity of our globe, might be accounted for, at the present rate of action, within such a period as 100 millions of years.[4] To my mind it has always seemed that whatever

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[1] "The Age of the Earth," being the Annual Address to the Victoria Institute, June 2, 1897.—*Phil. Mag.*, January 1899, p. 66. [2] *Recent Advances in Physical Science*, p. 174.

[3] Presidential Address.—*Quart. Journ. Geol. Soc.*, 1869.

[4] *Trans. Geol. Soc. Glasgow*, vol. iii. (March 26, 1868), p. 189. Sir W. Thomson acknowledged my adhesion in his reply to Huxley's criticism.—*Op. cit.* p. 221.

tends to give more precision to the chronology of the geologist, and helps him to a clearer conception of the antiquity with which he has to deal, ought to be welcomed by him as a valuable assistance in his inquiries. And I feel sure that this view of the matter has now become general among those engaged in geological research. Frank recognition is made of the influence which Lord Kelvin's persistent attacks have had upon our science. Geologists have been led by his criticisms to revise their chronology. They gratefully acknowledge that to him they owe the introduction of important new lines of investigation, which link the solution of the problems of geology with those of physics. They realise how much he has done to dissipate the former vague conceptions as to the duration of geological history, and even when they emphatically dissent from the greatly restricted bounds within which he would now limit that history, and when they declare their inability to perceive that any reform of their speculations in this subject is needful, or that their science has placed herself in opposition to the principles of physics, they none the less pay their sincere homage to one who has thrown over geology, as over so many other departments of natural knowledge, the clear light of a penetrating and original genius.

When Lord Kelvin first developed his strictures on modern geology he expressed his opposition in the most uncompromising language. In the short paper to which reference has already been made he announced, without hesitation or palliation, that he "briefly refuted" the doctrine of Uniformitarianism which had been espoused and illustrated by Lyell and a long list of the ablest geologists of the day. The severity of his judgment of British geology was not more marked than was his unqualified reliance on his own methods and results. This confident assurance of a distinguished physicist, together with a formidable array of mathematical formulæ, produced its effect on some geologists and palæontologists who were not Gallios. Thus, even after Huxley's brilliant defence, Darwin could not conceal the deep impression which Lord Kelvin's arguments had made on his mind. In one letter he wrote that the proposed limitation of geological time was one of his "sorest troubles." In another, he pronounced the physicist himself to be "an odious spectre."[1]

The same self-confidence of assertion on the part of some, at least, of the disputants on the physical side has continued all through the controversy. Yet when we examine the three great physical arguments in themselves, we find them to rest on assumptions which, though certified as "probable" or "very sure," are nevertheless admittedly assumptions. The conclusions to which these assumptions lead must depend for their validity on the degree of approximation to the truth in the premises which are postulated.

Now it is interesting to observe that neither the assumptions nor the conclusions drawn from them have commanded universal assent even among physicists themselves. If they were as self-evident as they have been claimed to be, they should at least receive the loyal support of all

[1] Darwin's *Life and Letters*, vol. iii. pp. 115, 146.

those whose function it is to pursue and extend the applications of physics. It will be remembered, however, that thirteen years ago Professor George Darwin, who has so often shown his inherited sympathy in geological investigation, devoted his presidential address before the Mathematical Section of this Association to a review of the three famous physical arguments respecting the age of the earth. He summed up his judgment of them in the following words: "In considering these three arguments I have adduced some reasons against the validity of the first [tidal friction]; and have endeavoured to show that there are elements of uncertainty surrounding the second [secular cooling of the earth]; nevertheless they undoubtedly constitute a contribution of the first importance to physical geology. Whilst, then, we may protest against the precision with which Professor Tait seeks to deduce results from them, we are fully justified in following Sir William Thomson, who says that 'the existing state of things on the earth, life on the earth—all geological history showing continuity of life, must be limited within some such period of past time as 100,000,000 years.'"[1]

More recently Professor Perry has entered the lists, from the physical side, to challenge the validity of the conclusions so confidently put forward in limitation of the age of the earth. He has boldly impugned each of the three physical arguments. That which is based on tidal retardation, following Mr. Maxwell Close and Professor Darwin, he dismisses as fallacious. In regard to the argument from the secular cooling of the earth, he contends that it is perfectly allowable to assume a much higher conductivity for the interior of the globe, and that this assumption would vastly increase our estimate of the age of the planet. As to the conclusions drawn from the history of the sun, he maintains that, on the one hand, the sun may have been repeatedly fed by infalling meteorites, and that on the other the earth, during former ages, may have had its heat retained by a dense atmospheric envelope. He thinks that "almost anything is possible as to the present internal state of the earth," and he concludes in these words: "To sum up, we can find no published record of any lower maximum age of life on the earth, as calculated by physicists, than 400 millions of years. From the three physical arguments, Lord Kelvin's higher limits are 1000, 400, and 500 million years. I have shown that we have reasons for believing that the age, from all these, may be very considerably underestimated. It is to be observed that if we exclude everything but the arguments from mere physics, the *probable* age of life on the earth is much less than any of the above estimates; but if the palæontologists have good reasons for demanding much greater times, I see nothing from the physicist's point of view which denies them four times the greatest of these estimates."[2]

This remarkable admission from a recognised authority on the physical side re-echoes and emphasises the warning pronounced by Professor Darwin in the address already quoted—"at present our knowledge of a definite limit to geological time has so little precision that we should do wrong to summarily reject any theories which appear

[1] *Rep. Brit. Assoc.*, 1886, p. 517.

[2] *Nature*, vol. li. p. 585, April 18, 1895.

to demand longer periods of time than those which now appear allowable."[1]

This "wrong," which Professor Darwin so seriously deprecated, has been committed not once, but again and again, in the history of this discussion. Lord Kelvin has never taken any notice of the strong body of evidence adduced by geologists and palæontologists in favour of a much longer antiquity than he is now disposed to allow for the age of the earth. His own three physical arguments have been successively restated, with such corrections and modifications as he has found to be necessary, and no doubt further alterations are in store for them. He has cut off slice after slice from the allowance of time which at first he was prepared to grant for the evolution of geological history, his latest pronouncement being that "it was more than twenty and less than forty million years, and probably much nearer twenty than forty."[2] But in none of his papers is there an admission that geology and palæontology, though they have again and again raised their voices in protest, have anything to say in the matter that is worthy of consideration.

It is difficult satisfactorily to carry on a discussion in which your opponent entirely ignores your arguments, while you have given the fullest attention to his. In the present instance, geologists have most carefully listened to all that has been brought forward from the physical side. Impressed by the force of the physical reasoning, they no longer believe that they can make any demands they may please on past time. They have been willing to accept Lord Kelvin's original estimate of 100 millions of years as the period within which the history of life upon the planet must be comprised; while some of them have even sought in various ways to reduce that sum nearer to his lower limit. Yet there is undoubtedly a prevalent misgiving, whether, in thus seeking to reconcile their requirements with the demands of the physicist, they are not tying themselves down within limits of time which on any theory of evolution would have been insufficient for the development of the animal and vegetable kingdoms.

It is unnecessary to recapitulate before this Section of the British Association, even in briefest outline, the reasoning of geologists and palæontologists which leads them to conclude that the history recorded in the crust of the earth must have required for its transaction a much vaster period of time than that to which the physicists would now restrict it.[3] Let me merely remark that the reasoning is essentially based on observations of the present rate of geological and biological changes upon the earth's surface. It is not, of course, maintained that this rate has never varied in the past. But it is the only rate with which we are familiar, which we can watch and in some degree measure,

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[1] *Rep. Brit. Assoc.*, 1886, p. 518.

[2] "The Age of the Earth," Presidential Address to the Victoria Institute for 1897, p. 10; also in *Phil. Mag.*, January 1899.

[3] The geological arguments are briefly given in my Presidential Address to the British Association at the Edinburgh Meeting of 1892. The biological arguments were well stated, and in some detail, by Professor Poulton in his Address to the Zoological Section of the Association at the Liverpool Meeting of 1896.

and which, therefore, we can take as a guide towards the comprehension and interpretation of the past history of our planet.

It may be, and has often been, said that the present scale of geological and biological processes cannot be accepted as a reliable measure for the past. Starting from the postulate, which no one will dispute, that the total sum of terrestrial energy was once greater than it is now and has been steadily declining, the physicists have boldly asserted that all kinds of geological action must have been more vigorous and rapid during bygone ages than they are to-day; that volcanoes were more gigantic, earthquakes more frequent and destructive, mountain upthrows more stupendous, tides and waves more powerful, and commotions of the atmosphere more violent, with more ruinous tempests and heavier rainfall. Assertions of this kind are temptingly plausible and are easily made. But it is not enough that they should be made; they ought to be supported by some kind of evidence to show that they are founded on actual fact and not on mere theoretical possibility. Such evidence, if it existed, could surely be produced. The chronicle of the earth's history, from a very early period down to the present time, has been legibly written within the sedimentary formations of the terrestrial crust. Let the appeal be made to that register. Does it lend any support to the affirmation that the geological processes are now feebler and slower than they used to be? If it does, the physicists, we might suppose, would gladly bring forward its evidence as irrefragable confirmation of the soundness of their contention. But the geologists have found no such confirmation. On the contrary, they have been unable to discover any indication that the rate of geological causation has ever, on the whole, greatly varied during the time which has elapsed since the deposition of the oldest stratified rocks. They do not assert that there has been no variation, that there have been no periods of greater activity, both hypogene and epigene. But they maintain that the demonstration of the existence of such periods has yet to be made. They most confidently affirm that whatever may have happened in the earliest ages, in the whole vast succession of sedimentary strata nothing has yet been detected which necessarily demands that more violent and rapid action which the physicists suppose to have been the order of nature during the past.

So far as the potent effects of prolonged denudation permit us to judge, the latest mountain-upheavals were at least as stupendous as any of older date whereof the basal relics can yet be detected. They seem, indeed, to have been still more gigantic than those. It may be doubted, for example, whether among the vestiges that remain of Mesozoic or Palæozoic mountain-chains any instance can be found so colossal as those of Tertiary times, such as the Alps. No volcanic eruptions of the older geological periods can compare in extent or volume with those of Tertiary and recent date. The plication and dislocation of the terrestrial crust are proportionately as conspicuously displayed among the younger as among the older formations, though the latter, from their greater antiquity, have suffered during a longer time from the renewed disturbances of successive periods.

As regards evidence of greater violence in the surrounding envelopes of atmosphere and ocean, we seek for it in vain among the stratified rocks. Among the very oldest formations of these islands, the Torridon sandstone of North-West Scotland presents us with a picture of long-continued sedimentation, such as may be seen in progress now round the shores of many a mountain-girdled lake. In that venerable deposit, the enclosed pebbles are not mere angular blocks and chips, swept by a sudden flood or destructive tide from off the surface of the land, and huddled together in confused heaps over the floor of the sea. They have been rounded and polished by the quiet operation of running water, as stones are rounded and polished now in the channels of brooks or on the shores of lake and sea. They have been laid gently down above each other, layer over layer, with fine sand sifted in between them, and this deposition has taken place along shores which, though the waters that washed them have long since disappeared, can still be followed for mile after mile across the mountains and glens of the North-West Highlands. So tranquil were these waters that their gentle currents and oscillations sufficed to ripple the sandy floor, to arrange the sediment in laminæ of current bedding, and to separate the grains of sand according to their relative densities. We may even now trace the results of these operations in thin darker layers and streaks of magnetic iron, zircon, and other heavy minerals, which have been sorted out from the lighter quartz-grains, as layers of iron-sand may be seen sifted together by the tide along the upper margins of many of our sandy beaches at the present day.

In the same ancient formation there occur also various intercalations of fine muddy sediment, so regular in their thin alternations, and so like those of younger formations, that we cannot but hope and expect that they may eventually yield remains of organisms which, if found, would be the earliest traces of life in Europe.

It is thus abundantly manifest that even in the most ancient of the sedimentary registers of the earth's history, not only is there no evidence of colossal floods, tides, and denudation, but there is incontrovertible proof of continuous orderly deposition, such as may be witnessed to-day in any quarter of the globe. The same tale, with endless additional details, is told all through the stratified formations down to those which are in the course of accumulation at the present day.

Not less important than the stratigraphical is the palæontological evidence in favour of the general quietude of the geological processes in the past. The conclusions drawn from the nature and arrangement of the sediments are corroborated and much extended by the structure and manner of entombment of the enclosed organic remains. From the time of the very earliest fossiliferous formations there is nothing to show that either plants or animals have had to contend with physical conditions of environment different, on the whole, from those in which their successors now live. The oldest trees, so far as regards their outer form and internal structure, betoken an atmosphere neither more tempestuous nor obviously more impure than that of to-day. The earliest corals, sponges, crustaceans, molluscs, and arachnids were not more stoutly con-

structed than those of later times, and are found grouped together among the rocks as they lived and died, with no apparent indication that any violent commotion of the elements tried their strength when living, or swept away their remains when dead.

But, undoubtedly, most impressive of all the palæontological data is the testimony borne by the grand succession of organic remains among the stratified rocks as to the vast duration of time required for their evolution. Professor Poulton has treated this branch of the subject with great fulness and ability. We do not know the present average rates of organic variation, but all the available evidence goes to indicate their extreme slowness. They may conceivably have been more rapid in the past, or they may have been liable to fluctuations according to vicissitudes of environment.[1] But those who assert that the rate of biological evolution ever differed materially from what it may now be inferred to be, ought surely to bring forward something more than mere assertion in their support. In the meantime, the most philosophical course is undoubtedly followed by those biologists who in this matter rest their belief on their own experience among recent and fossil organisms.

So cogent do these geological and palæontological arguments appear, to those at least who have taken the trouble to master them, that they are worthy of being employed, not in defence merely, but in attack. It seems to me that they may be used with effect in assailing the stronghold of speculation and assumption in which our physical friends have ensconced themselves and from which, with their feet, as they believe, planted well within the interior of the globe and their heads in the heart of the sun, they view with complete unconcern the efforts made by those who endeavour to gather the truth from the surface and crust of the earth. That portion of the records of terrestrial history which lies open to our investigation has been diligently studied in all parts of the world. A vast body of facts has been gathered together from this extended and combined research. The chronicle registered in the earth's crust, though not complete, is legible and consistent. From the latest to the earliest of its chapters the story is capable of clear and harmonious interpretation by a comparison of its pages with the present condition of things. We know infinitely more of the history of this earth than we do of the history of the sun. Are we then to be told that this knowledge, so patiently accumulated from innumerable observations and so laboriously co-ordinated and classified, is to be held of none account in comparison with the conclusions of physical science in regard to the history of the central luminary of our system? These conclusions are founded on assumptions which may or may not correspond with the truth. They have already undergone revision, and they may be still further modified as our slender knowledge of the sun, and of the details of its history, is increased by future investigation. In the meantime, we decline to accept them as a final

[1] See an interesting and suggestive paper by Professor Le Conte on "Critical Periods in the History of the Earth," *Bull. Dept. Geology, University of California*, vol. i. (1895), p. 313; also one by Professor Chamberlin on "The Ulterior Basis of Time-Divisions and the Classification of Geological History," *Journal of Geology*, vol. vi. (1898), p. 449.

pronouncement of science on the subject. We place over against them the evidence of geology and palæontology, and affirm that unless the deductions we draw from that evidence can be disproved, we are entitled to maintain them as entirely borne out by the testimony of the rocks.

Until, therefore, it can be shown that geologists and palæontologists have misinterpreted their records, they are surely well within their logical rights in claiming as much time for the history of this earth as the vast body of evidence accumulated by them demands. So far as I have been able to form an opinion, one hundred millions of years would suffice for that portion of the history which is registered in the stratified rocks of the crust. But if the palæontologists find such a period too narrow for their requirements, I can see no reason on the geological side why they should not be at liberty to enlarge it as far as they may find to be needful for the evolution of organised existence on the globe. As I have already remarked, it is not the length of time which interests us so much as the determination of the relative chronology of the events which were transacted within that time. As to the general succession of these events, there can be no dispute. We have traced its stages from the bottom of the oldest rocks up to the surface of the present continents and the floor of the present seas. We know that these stages have followed each other in orderly advance, and that geological time, whatever limits may be assigned to it, has sufficed for the passage of the long stately procession.

We may, therefore, well leave the dispute about the age of the earth to the decision of the future. In so doing, however, I should be glad if we could carry away from it something of greater service to science than the consciousness of having striven our best in a barren controversy, wherein concession has all to be on one side and the selection of arguments entirely on the other. During these years of prolonged debate I have often been painfully conscious that in this subject, as in so many others throughout the geological domain, the want of accurate numerical data is a serious hindrance to the progress of our science. Heartily do I acknowledge that much has been done in the way of measurements and experiments for the purpose of providing a foundation for estimates and deductions. But infinitely more remains to be accomplished. The field of investigation is almost boundless, for there is hardly a department of geological dynamics over which it does not extend. The range of experimental geology must be widely enlarged, until every process susceptible of illustration or measurement by artificial means has been investigated. Field-observation needs to be supplemented where possible by instrumental determinations, so as to be made more precise and accurate, and more capable of furnishing reliable numerical statistics for practical as well as theoretical deductions.

The subject is too vast for adequate treatment here. But let me illustrate my meaning by selecting a few instances where the adoption of these more rigid methods of inquiry might powerfully assist us in dealing with the rates of geological processes and the value of geological time. Take, for example, the wide range of lines of investigation embraced under the head of Denudation. So voluminous a series of

observations has been made in this subject, and so ample is the literature devoted to it, that no department of geology, it might be thought, has been more abundantly and successfully explored. Yet if we look through the pile of memoirs, articles, and books, we cannot but be struck with the predominant vagueness of their statements, and with the general absence of such numerical data determined by accurate, systematic, and prolonged measurement as would alone furnish a satisfactory basis for computations of the rate at which denudation takes place. Some instrumental observations of the greatest value have indeed been made, but, for the most part, observations of this kind have been too meagre and desultory.

A little consideration will show that in all branches of the investigation of denudation opportunities present themselves on every side of testing, by accurate instrumental observation and measurement, the rate at which some of the most universal processes in the geological *régime* of our globe are carried on.

It has long been a commonplace of geology that the amount of the material removed in suspension and solution by rivers furnishes a clue to the rate of denudation of the regions drained by the rivers. But how unequal in value, and generally how insufficient in precision, are the observations on this topic! A few rivers have been more or less systematically examined, some widely varying results have been obtained from the observations, and while enough has been obtained to show the interest and importance of the method of research, no adequate supply of materials has been gathered for the purposes of accurate deduction and generalisation. What we need is a carefully organised series of observations carried out on a uniform plan, over a sufficient number of years, not for one river only, but for all the important rivers of a country, and indeed for all the greater rivers of each continent. We ought to know as accurately as possible the extent of the drainage-area of each river, the relations of river-discharge to rainfall and to other meteorological as well as topographical conditions; the variation in the proportions of mechanical and chemical impurities in the river-water according to geological formations, form of the ground, season of the year and climate. The whole geological *régime* of each river should be thoroughly studied. The admirable report of Messrs. Humphreys and Abbot on the "Physics and Hydraulics of the Mississippi," published in 1861, might well serve as a model for imitation, though these observers necessarily occupied themselves with some questions which are not specially geological and did not enter into others on which, as geologists, we should now gladly have further information.

Again, the action of glaciers has still less been subjected to prolonged and systematic observation. The few data already obtained are so vague that we may be said to be still entirely ignorant of the rate at which glaciers are wearing down their channels and contributing to the denudation of the land.

The whole of this inquiry is eminently suitable for combined research. Each stream or glacier, or each well-marked section of one, might become the special inquiry of a single observer, who would soon develop a paternal

interest in his valley, and vie with his colleagues of other valleys in the fulness and accuracy of his records.

Nor is our information respecting the operations of the sea much more precise. Even in an island like Great Britain, where the waves and tides effect so much change within the space of a human life-time, the estimates of the rate of advance or retreat of the shore-line are based for the most part on no accurate determinations. It is satisfactory to be able to announce that the Council of this Association has formed a Committee for the purpose of obtaining full and accurate information regarding alterations of our coasts, and that with the sanction of the Lords of the Admiralty the co-operation of the Coastguard throughout the three kingdoms has been secured. We may therefore hope to be eventually in possession of trustworthy statistics on this interesting subject.

The disintegration of the surface of the land by the combined agency of the Subaërial forces of decay is a problem which has been much studied, but in regard to whose varying rates of advance not much has been definitely ascertained. The meteorological conditions under which it takes place differ materially according to latitude and climate, and doubtless its progress is equally variable. An obvious and useful source of information in regard to atmospheric denudations is to be found in the decay of the material of buildings of which the time of erection is known, and in dated tombstones. Twenty years ago I called attention to the rate at which marble gives way in such a moist climate as ours, and cited the effects of subaërial waste as these can be measured on the monuments of our graveyards and cemeteries.[1] I would urge upon town geologists, and those in the country who have no opportunities of venturing far afield, that they may do good service by careful scrutiny of ancient buildings and monuments. In the churchyards they will find much to occupy and interest them, not, however, like Old Mortality, in repairing the tombstones, but in tracing the ravages of the weather upon them, and in obtaining definite measures of the rate of their decay.

The conditions under which subaërial disintegration is effected in arid climates, and the rate of its advance, are still less known, seeing that most of our information is derived from the chance observations of passing travellers. Yet this branch of the subject is not without importance in relation to the denudation not only of the existing terrestrial surface but of the lands of former periods, for there is evidence of more than one arid epoch in geological history. Here, again, a diligent examination of ancient buildings and monuments might afford some, at least, of the required data. In such a country as Egypt, for instance, it might eventually be possible to determine from a large series of observations what has been the average rate of surface-disintegration of the various kinds of stone employed in human constructions that have been freely exposed to the air for several thousand years.

Closely linked with the question of denudation is that of the Deposition of the material worn away from the surface of the land. The total

[1] *Proc. Roy. Soc. Edin.*, vol. x. (1879-80), p. 518.

amount of sediment laid down must equal the amount of material abstracted, save in so far as the soluble portions of that material are retained in solution in the sea. But we have still much to learn as to the conditions, and especially as to the rate, of sedimentation. Nor does there appear to be much hope of any considerable increase to our knowledge until the subject is taken up in earnest as one demanding and justifying a prolonged series of well-planned and carefully executed observations. We have yet to discover the different rates of deposit, under the varying conditions in which it is carried on in lakes, estuaries, and the sea. What, for instance, would be a fair average for the rate at which the lakes of each country of Europe are now being silted up? If this rate were ascertained, and if the amount of material already deposited in these basins were determined, we should be in possession of data for estimating not only the probable time when the lakes will disappear, but also the approximate date at which they came into existence.

But it is not merely in regard to epigene changes that further more extended and concerted observation is needed. Even among Subterranean movements there are some which might be watched and recorded with far more care and continuity than have ever been attempted. The researches of Professor George Darwin and others have shown how constant are the tremors, minute but measurable, to which the crust of the earth is subject.[1] Do these phenomena indicate displacements of the crust, and if so, what in the lapse of a century is their cumulative effect on the surface of the land?

More momentous in their consequences are the disturbances which traverse mountain-chains and find their most violent expression in shocks of Earthquake. The effects of such shocks have been studied and recorded in many parts of the world, but their cause is still little understood. Are the disturbances due to a continuation of the same operation which at first gave birth to the mountains? Should they be regarded as symptoms of growth or of collapse? Are they accompanied by even the slightest amount of elevation or depression? We cannot tell. But these questions are probably susceptible of some more or less definite answer. It might be possible, for instance, to determine with extreme precision the heights above a given datum of various fixed points along such a chain as the Alps, and by a series of minutely accurate measurements to detect any upward or downward deviation from these heights. It is quite conceivable that throughout the whole historical period some deviation of this kind has been going on, though so slowly, or by such slight increments at each period of renewal, as to escape ordinary observation. We might thus learn whether, after an Alpine earthquake, an appreciable difference of level is anywhere discoverable, whether the Alps as a great mountain-chain are still growing or are now subsiding, and we might be able to ascertain the rate of the movement. Although changes of this nature may have been too slight during human experience to be ordinarily appreciable, their very insignifi-

[1] *Report Brit. Assoc.*, 1882, p. 95.

cance seems to me to supply a strong reason why they should be sought for and carefully measured. They would not tell us, indeed, whether a mountain-chain was called into being in one gigantic convulsion, or was raised at wide intervals by successive uplifts, or was slowly elevated by one prolonged and continuous movement. But they might furnish us with suggestive information as to the rate at which upheaval or depression of the terrestrial crust is now going on.

The vexed questions of the origin of Raised Beaches and Sunk Forests might in like manner be elucidated by well-devised measurements. It is astonishing upon what loose and unreliable evidence the elevation or depression of coast-lines has often been asserted. On shores where proofs of a recent change of level are observable it would not be difficult to establish by accurate observation whether any such movements are taking place now, and, if they are, to determine their rate. The old attempts of this kind along the coasts of Scandinavia might be resumed with far more precision, and on a much more extended scale. Methods of instrumental research have been vastly improved since the days of Celsius and Linnæus. Mere eye observations would not supply sufficiently accurate results. When the datum-line has been determined with rigorous accuracy, the minutest changes of level, such as would be wholly inappreciable to the senses, might be detected and recorded. If such a system of watch were maintained along coasts where there is reason to believe that some rise or fall of land is taking place, it would be possible to follow the progress of the movement and to determine its rate.

But I must not dwell longer on examples of the advantages which geology would gain from a far more general and systematic adoption of methods of experiment and measurement in elucidation of the problems of the science. I have referred to a few of those which have a more special bearing on the question of geological time, but it is obvious that the same methods might be extended into almost every branch of geological dynamics. While we gladly and gratefully recognise the large amount of admirable work that has already been done by the adoption of these practical methods, from the time of Hall, the founder of experimental geology, down to our own day, we cannot but feel that our very appreciation of the gain which the science has thus derived increases the desire to see the practice still further multiplied and extended. I am confident that it is in this direction more than in any other that the next great advances of geology are to be anticipated.

While much may be done by individual students, it is less to their single efforts than to the combined investigations of many fellow-workers that I look most hopefully for the accumulation of data towards the determination of the present rate of geological changes. I would, therefore, commend this subject to the geologists of this and other countries as one in which individual, national, and international co-operation might well be enlisted. We already possess an institution which seems well adapted to undertake and control an enterprise of the kind suggested. The International Geological Congress, which brings together our associates from all parts of the globe, would confer a lasting

benefit on the science if it could organise a system of combined observation in any single one of the departments of inquiry which I have indicated, or in any other which might be selected. We need not at first be too ambitious. The simplest, easiest, and least costly series of observations might be chosen for a beginning. The work might be distributed among the different countries represented in the Congress. Each nation would be entirely free in its selection of subjects for investigation, and would have the stimulus of co-operation with other nations in its work. The Congress will hold its triennial gathering next year in Paris, and if such an organisation of research as I have suggested could then be inaugurated, a great impetus would thereby be given to geological research, and France, again become the birthplace of another scientific movement, would acquire a fresh claim to the admiration and gratitude of geologists in every part of the globe.

THE TRANSVAAL AND THE ORANGE FREE STATE.

THE first European settlement in South Africa was made by the Dutch East India Company, which in 1652 sent an expedition to Table Bay under the command of Jan van Riebeek. The men under his control were servants of the Company, and the main object of the latter was principally to form a post for provisioning their vessels on the voyage to the East. Immigration, therefore, was not encouraged, and though grants of land were made to free settlers in 1657, these new comers were subject to many vexatious regulations.

When the Batavian Republic was proclaimed in 1795, and the Stadtholder fled to England, he urged the British Government to seize the foreign possessions of Holland, which was leagued with the French, and accordingly in that year Admiral Elphinstone sailed with a large fleet to the Cape, and the Dutch were defeated at Muizenberg by the troops under the command of General Craig. In 1802 the colony was restored to Holland by the treaty of Amiens, and the British garrison abandoned Cape Town in the following year. But, war being declared again in 1805, the British once more took possession of the colony, retaining it in their hands until it was finally assigned to them by the treaty of Paris in 1814, confirmed by the Congress of Vienna in the following year.

Owing to the policy of the Dutch East India Company and continual troubles with the natives, the colony was still confined within narrow limits, not extending eastwards farther than the Great Fish river, and was sparsely settled. In 1820 a considerable number of settlers were sent out from England, Scotland, and Ireland, and repeated wars with the Kafirs led to the annexation of the province of Queen Adelaide between the Kei and Keiskamma rivers, but in 1835 Lord Glenelg set back the boundary to the Great Fish river, causing great discontent among both Dutch and British colonists.

The Boers, irritated by this concession to the Kafirs and by the abolition of slavery decreed in 1835 and consummated in 1838, "trekked" in considerable numbers across the Orange river, congregating near Thabanchu. Thence small parties advanced towards the Vaal river, and were massacred by the Matabili. A larger body under Hendrik Potgieter, moving more cautiously, repulsed the Matabili in 1838, and finally routed them at their chief kraal, Mosega, in the Marico district.

A party of Boers under Pieter Retief moved into the Natal territory, which was ceded to them by the Zulu chief, Dingaan. But they soon found that their confidence in Dingaan had been misplaced. Retief, with seventy companions, was treacherously murdered in the chief's kraal, and the next morning the camps of the Boers on the Bushman and Blaauwkrantz rivers were attacked by the Zulu armies. To this battle the town of Weenen (Weeping) owes its name. Though their losses were heavy, the Boers, reinforced by a contingent from the west, attacked Dingaan's kraal, defeated the Zulus again under the leadership of Andries Pretorius at the Umhlatoos river, and joining Panda, Dingaan's brother, drove the chief from his country. Panda became king of the Zulus and formed an alliance with the Boers.

The Boers set to work to organise the Republic of Natalia, as they called their new country. A small number of British colonists had long occupied lands in the neighbourhood of Port Natal (Durban), and a small detachment of soldiers was stationed there, but was withdrawn in 1839. On hearing that the immigrants had been obliged to send an expedition against a chief on the Pondoland border, the governor of Cape Colony decided to re-establish his authority throughout the country to prevent complications. After a stubborn resistance the Boers were forced to submit, and Natal was proclaimed British territory in 1843. But the administration was not properly organised until 1845, and meanwhile large numbers of Zulus flocked across the Tugela to escape the rule of Panda. Sir H. Smith refused to lend military assistance to drive the intruders back, and therefore the Boers began to trek across the Drakensberg.

Many Dutch farmers migrated to the country between the Orange and Vaal rivers, now forming the Orange Free State, and in consequence of frequent quarrels between them and the natives, the country was proclaimed to be British territory in 1845, and the proclamation was confirmed in 1848. Then a malcontent party rose in rebellion, Pretorius being again their leader. Being defeated at Boomplaats near Smithfield, they retreated across the Vaal river and joined the former immigrants. The name of the capital, Pretoria, perpetuates the memory of their leader. With this Republic an agreement, the Zand River Convention, was signed in 1852, which continued in force till 1877.

The Orange river territory did not long remain in British hands. Difficulties having arisen with the native tribes, particularly the Basutos, the Government, which had only just brought to an end a Kafir war, decided to avoid further complications, and in 1854 protection was withdrawn, to the great alarm of many of the inhabitants, and the farmers were left to form a republic under the name of the Orange Free

State. Those Griquas (offspring of Boers and Hottentots) whose lands were situated within the territory of the new republic, were removed to the district bordering on Natal, named in consequence Griqualand East.

The Basutos always cherished a bitter hatred against the Boers, and their losses in repeated conflicts with the Orange Free State threatened to end in their total extinction. Consequently the British Government was obliged to interfere, and Basutoland was proclaimed British territory by Sir Philip Wodehouse in 1868. The following year the boundary of Basutoland towards the Orange Free State was fixed. The western boundary of the Orange Free State remained undetermined until the discovery of diamonds near the site of the present town of Kimberley. The Griqua chief, Waterboer, protested against the claim of the Free State to this country, and was received under British protection in 1871. In 1876 the Free State withdrew its claim on receiving a sum of money from the Government.

Meanwhile the Boers of the Transvaal, who had been reinforced by many other Dutch farmers after the Zand River Convention was signed, had been sadly mismanaging their affairs. Two republics had been formed, one including Potchefstroom, Rustenburg, Pretoria, and Zoutpansberg, the other the districts of Lydenburg and Utrecht. These were united in 1860 as the South African Republic with Pretoria as its capital. In 1875-76 the Republic was brought to the verge of ruin by a war with Sekukuni, a native chief living in the Lydenburg district. The treasury was almost empty, and the president, François Burgers, had failed in obtaining loans for the construction of railways. Sir Theophilus Shepstone annexed the Transvaal in 1877, and an expedition under the command of Sir Garnet Wolseley stormed Sekukuni's stronghold. In 1881 the Pretoria Convention was signed, by which self-government was granted to the Transvaal, and a supplementary convention was signed in 1884, by which, among other matters, the frontier was defined, the Transvaal receiving an accession of territory on its south-western border. In 1886 the New Republic established by some Boers in Zululand was incorporated into the Transvaal, forming the Vryheid district, and in 1895 Swaziland was placed under the protection of the Transvaal Government with certain restrictions.

The Quathlamba or Drakensberg stretches northward along the eastern border of Basutoland and the Orange Free State into the Transvaal, with an average altitude of 8000 to 10,000 feet. In the Transvaal it is somewhat lower, reaching its culminating point in the Mauchberg (8730), the loftiest elevation in the Republic. Eastwards, towards the coast, it descends rapidly in terraces, but on the western side it has a less imposing appearance, forming the edge of the central plateau which lies 3000 to 4000 feet above sea-level. Beyond the Olifant's river it breaks up into isolated chains, such as the Murchison and Zoutpansberg, running east and west. Other ranges in the Transvaal lie in the same direction, as the Witwatersrand and the Magaliesberg in the south, and the Waterberg and the Blaauwberg in the north, which rarely exceed 4500 feet. The central and western parts of the Transvaal and the Free State are

bush country (Bosch Veld), lying 4000 feet above sea-level, studded with small hills, but with no extensive elevations rising above the general level. The eastern part of the Transvaal, between the Drakensberg and the Lobombo range, is on the terraced escarpment of the plateau, and sinks in many places as low as 2000 feet. Westwards, the bush country passes into the dry steppes of Bechuanaland, and on the south the Free State is bounded by the Orange river, beyond which the country sinks, as on the eastern side, in terraces towards the coast.

The drainage of the plateau is carried off by two great river systems, those of the Limpopo and the Orange river, the Witwatersrand in the south-west of the Transvaal forming the watershed between them. From the watershed the Limpopo sweeps round the northern border of the Transvaal Republic, emerges from the Zoutpansberg at the Tolo Azime falls, and entering Portuguese territory reaches the sea after a course of nearly 1000 miles. It receives several affluents from the Transvaal and also from Matabililand, and has a catchment basin of some 130,000 square miles, but many of the tributaries being dry, except in the wet season, its discharge is comparatively small.

Still more important is the Orange river. Its chief sources are situated in the Drakensberg, near the point where Natal, Basutoland, and the Orange Free State meet. The Senku, rising at the foot of Mont aux Sources (11,000 feet), is the principal headwater. On the Free State frontier the Orange is joined by the Kornet Spruit, and some 100 miles farther by the Caledon, which, along a great part of its course, divides the Free State from Basutoland. In Griqualand West it is joined by its greatest tributary, the Vaal. This river, also rising in the Drakensberg, but much farther north within the Transvaal territory, runs along most of the boundary between the Transvaal and Free State, receiving the Hart on its right bank and the Modder on its left.

Rain is most prevalent from October to April, when the winds from the south-east retain some of their moisture till they reach the plateau. In the east the annual rainfall is about 40 inches, at Johannesburg 30, while it falls to only 12 on the western border. The rain is on the whole very uncertain, great drought prevailing at times, while at others the rivers are swollen and cause large and destructive floods. The climate, owing to the altitude of the country and the dry winds from the Kalihari desert, is exceedingly healthy, with the exception of a few low-lying tracts on the Limpopo, Olifants, and other rivers of the eastern borderlands. The hot winds from the desert cause the average temperature to be rather high in spite of the elevation, the annual mean being 68° to 70° F.

Most of the Orange Free State is well adapted for grazing purposes, and the rearing of stock and ostriches is the principal occupation of the people. Wheat-growing is, however, rapidly extending, particularly in the south-eastern part of the territory—Ladysbrand, Wepener, Ficksburg—where the soil is exceptionally fertile. The detritus washed down from the sandstones and limestones of the adjacent hills enriches the valleys. The crops are yearly increasing, and this country may, when

transport is made less costly by the construction of railways, supply South Africa with cereals. Fruits also thrive, as well as trees—oak, pine, and fir.

The Hooge Veld, 4000 to 7000 feet high, occupies much of the south and east of the Transvaal, and is well suited for sheep. The Bosch Veld on the north, grassy country interspersed with low hills and trees, is adapted for cattle and corn, while in the extreme north (Waterberg, Zoutpansberg, etc.), coffee, sugar, and tropical produce would find a suitable climate. Tobacco of good quality is exported.

The chief wealth of the Transvaal consists, however, in its mines. The Yzerberg, near Marabasstad, is a mass of rich iron ore. Coal is found in Utrecht and Wakkerstroom, in Middelburg and Lydenburg, and copper, tin, lead, quicksilver, etc., are distributed over the country. But the most important mineral is gold. The best-known fields are the De Kaap and the Witwatersrand, though the mineral is also extracted in the Lydenburg and Zoutpansberg districts, and elsewhere. The De Kaap mines were opened in 1884, and caused a great rush of miners, but since the Witwatersrand fields have attracted so much attention, these fields have been somewhat neglected, and the town of Barberton has lost a large proportion of its inhabitants. The Witwatersrand consists of strata of sandstone, quartzite, slate, and conglomerate, tilted at a considerable angle. The gold is found in the conglomerate veins, which are called "banket" reefs from their resemblance to the sweetmeat called almond rock.

The mines of the Orange Free State are less important. Diamonds are found at Jagersfontein and Koffyfontein, and one or two other spots. Coal, magnetic iron, ochre, saltpetre, and salt are also worked.

The area of the Orange Free State is estimated at 48,326 miles. At the census of 1890 the white population numbered 77,716, and the natives 129,787. The capital is Bloemfontein, with a population of only about 3400, situated on a tributary of the Vaal at an elevation of 4500 feet. The Transvaal has an area of 119,139 square miles (not very much less than that of the British Isles), and a population (1898) of 1,094,156. Of these 345,397 are whites. How many of these are Boers it is difficult to determine—perhaps under 100,000. Johannesburg, the great mining town, on the Witwatersrand, *had* over 102,000 inhabitants, a large proportion of whom, as well as in Krugersdorp, Barberton, and other mining centres, were Uitlanders. Pretoria, the capital, has a population of about 10,000. It is about 1000 miles from Cape Town, 240 from Delagoa Bay, and 430 from Durban. Pretoria and Johannesburg are connected with Cape Colony by a railway passing Bloemfontein, with Natal by a railway through the famous Laing's Nek, and with Delagoa Bay by a line passing not far from Barberton, to which place there is a branch.

THE TIAN-SHAN: ITS VERTICAL RELIEF, HYDROGRAPHY, ETC.[1]

VERTICAL RELIEF.

THE most general characteristics of the relief of the Tian-shan are, firstly, that the absolute elevation rises gradually from the northern to the southern ranges of the system, while at the same time the relative heights of crests above the adjacent valleys diminish. This circumstance is of great importance for traffic. The traveller coming from the north gradually ascends without difficulty to the higher elevations and has not to descend very far on the southern slope, while from the southern side, after surmounting the steep slope from the Tarim basin, he finds a gentle descent across the entire system. The culminating points also follow the same law, being mostly situated on the southern extremities of the ranges overlooking the Tarim basin. In the second place, the elevation is greatest in the central part of the system and declines towards the east and west.

The heights of a considerable number of points have been measured or estimated, and the most important of these have been collected in tables by Dr. Friederichsen, each accompanied by the name of the observer and of the publication in which it is recorded. Comparatively, however, to the extent of the system these indications are few, so that it is not possible to reckon with any close approximation the mean height of the crests and saddles, and the mean *Schartung*, that is, the difference between the mean heights of the peaks and saddles, necessary for representation of relief in full detail. A general outline is alone attainable.

The ascent of the northern slope of the Dzungarian Ala-tau from the Balkash steppes and the Ala-kul hollow is interrupted by parallel ranges and the plateaus lying behind them. The main range seems to be fairly continuous, and from the sources of the Tentek to about 79½° E. long. rises above the snow-line (11,000 to 11,500 feet). The two well-known passes are high and difficult to cross, and therefore the Russian routes avoid the crest and make for the lower and easier passes over the western spurs. The southern slope towards the Borotala is steeper, shorter, and drier than the northern. The rise towards the south of the valley bottoms within the Ala-tau region is shown by the following figures:—Borotala valley, 4300 feet; Urtak-sary valley, 5600; Sairam-nor, 6800. These places lie about on the 81° meridian of east longitude.

Semionof gives the following limits of zones on the northern slope, so admirably adapted for the requirements of Russian colonists:—steppe zone, 525–1575 feet; zone of cultivation, 1575–4300; zone of

[1] We have to thank Dr. Max Friederichsen for a complete copy of his *Morphologie des Tien-schan*. We are thus able to draw up an abstract of the latter part (a *résumé* of the first part was published on p. 403).

coniferous trees, 4300–8100; alpine pasture, 8100–9500; higher alpine zone, 9500–11,900; and lastly, the zone of eternal snow.

The difference in the northern chain of the Iren-khabirgan range, east and west of the 83rd meridian, alluded to on p. 408, is distinctly marked by the altitudes recorded. To the west of that meridian they diminish considerably. A deep mantle of snow covers the range only farther to the east, and again disappears as the gap at Urumchi is approached. The Avral range on the south is free of snow except the glaciated region at the sources of the Kash, but appears to be snow-capped in its eastern prolongation up to the neighbourhood of the meridian of Urumchi. The Jargoz has no snow, but the Bogdo-ola is snow-capped. Owing to their inaccessibility the elevation of the higher parts of the Iren-khabirgan has seldom been estimated and never measured, but from the foregoing notices, and from the height of the snow-line it is evident that the crest must in many places considerably exceed 11,500 feet. In striking contrast to this height are the levels of the surrounding steppes and deserts—lowest point in Dzungaria at the Airik-nor, 755 feet; the Turfan depression −160 to −200 feet; the Ili basin, 990 to 1970 feet. This great difference of elevation between the foot and the crest of the mountains is naturally a great obstacle to communication. The chief route, the Pei-lu (North Road), keeps to the north outside the mountains and does not cross them till a diminution of the height affords an easy pass between the meridians of Sairam-nor and Ebi-nor. The Urumchi and Otun-koza hollows have been used for ages as gates through the mountain barrier.

The high valley of the Little Yuldus apparently lies in general at an elevation of from 7200 to 7900 feet. To the lowest swampy part of the Great Yuldus must be assigned a lower height to allow for the fall of the river. The plateau-like hollow drained by the Balgantai-gol is separated from the Little Yuldus valley by a watershed rising only about 800 feet above the adjoining country. The heights of the southern ranges in this part of the system are hardly known at all. Roborovski describes the passes Mukhurdai and Sari-tiur in the snow-covered Narat range as easily traversed, and estimates their heights at 11,800 and 10,800 feet respectively. Kozlof reports snow and glaciers on the border ranges overlooking the Tarim basin and Kucha.

The transition from the highlands of the Yuldus valleys to the Pei-shan seems to take place gradually. The Pei-shan is in general an undulation, which from a mean height of 4600 to 4900 feet gradually falls to the Gashun-nor at a height of 3300 feet, and is surmounted by hills and ranges of hills as a rule not more than 100 or 300 feet, and seldom rising to 3900 feet, above the general level.

The Trans-Ili Ala-tau, in the western half of the Tian-shan system, reaches its greatest elevation in the watershed between the Kebin and Chilik. Here the Talgarnyn-tal-choku rises far above the snow-line to an estimated height of 14,700 to 15,750 feet, whereas in other parts the mean height of the crest is about 9800 feet. East and west of this point snow lies on both of the Ala-tau chains, but there are no true glaciers. In either direction the altitude diminishes to the transverse

valleys of the Chu and the Kegen. The snow-line on the northern slope is at a higher level than on the Dzungarian Ala-tau. Where the range rises above it the ridge cannot be crossed; where it falls below it the passes are numerous, and those on the north and south chains often face one another. The mean of the barometrical measurements of the passes on the northern range between Kastek and the Seirek pass is 8500 feet, and of the fewer measurements in the southern range and in the eastern half of the Alexander chain 9700. The great difference of altitude between the mountains and the low adjoining land makes the approach to the passes not very convenient.

Of the Temurlik-tau no exact measurements have been taken; on Petermann's map to Severtsof's travels it is marked as snow-capped, but whether correctly is doubtful.

The slope of the Alexander chain towards the Chu steppe on the north is rough and steep. The summits do not, as a rule, rise above the snow-line, but occasionally reach to 12,800 or 13,800 feet. Near Aulie-ata the mountains come to an end at a height of 2460 feet.

In the Kara-tau the heights are not very great (5900 to 7900 feet). It is only after its union with the Talas-tau that the mountains rise into the region of eternal snow, the summits attaining to 15,700 feet. Farther westwards the height sinks, where, as formerly remarked, the trade route passes through the whole breadth of the mountains. East of the pass Ula-khol the ridge rises again and attains its maximum elevation at the point where the Terskei Ala-tau coalesces with the Khan-Tengri. In this section the Terskei Ala-tau bears snow and therefore is considerably above 11,500 feet. The heights of the passes show the rise towards the Khan-Tengri. The passes of the Terskei Ala-tau have an average height of 12,100 feet, while in the neighbourhood of the Son-kul the average is 9800 feet. The ascent from the Issyk-kul, 5300 feet above sea-level, to the summits of the passes is about 6600 feet.

The general law of the increase of the absolute and the decrease of the relative heights from north to south in the Tian-shan system, as well as of the fall from the central parts of the Khan-Tengri group towards the west, is well illustrated by the recorded heights in the Naryn and Khan-Tengri highlands. The Khan-Tengri itself is the most massive elevation in the whole Tian-shan system, and one of the few places where extensive and fairly well-explored glaciers exist. East and west the altitude of the valley bottoms diminishes, and that of the skirting ranges. Ridges of considerable altitude, and capped with snow, rise only 1300 to 2000 feet above the general base, which stands 6500 to 9800 feet above sea-level. The general inclination from north to south is exhibited by the following figures:—Issyk-kul, 5300 feet; the Kochkar basin (sources of the Chu), 6070; Son-kul, 9426; Chatyr-kul, 11,320; the Atbash valley, 7550; the Ak-sai valley, 9800 to 11,150.

The existence of a snow cap is some indication of the height of these mountains, though not so trustworthy as in the case of the various Ala-tau ranges. Severtsof remarked that the terrace form raised the snow-line by nearly 1000 feet, that is, up to about 12,500 feet. The heating of the plateaus, the smaller amount of precipitation, and the fineness of

the snow, which is easily blown away, account for this fact. Nearer the Tarim basin the snow-line seems to rise still higher, for Severtsof estimates its height on the Kokiya range at 13,000 to 13,800 feet. With the great elevation of the mountainous district beside the Naryn river the average elevation of the passes accords, being over 13,000 feet in the extremities of the chains towards the Tarim basin and in the Khan-Tengri group, and about 11,500 for the whole Naryn district.

Past the culminating point eastwards the ranges are not much known. The heights of the Mussart pass, 12,000 feet, and of the most frequented passes over the Narat range, are estimated at 11,800 and 10,800, and the snow that covers the crests indicates a great elevation.

The Tarim basin lies far higher than the steppes and deserts on the northern side of the Tian-shan. It is a typical Central Asian basin, in which the utter desolateness is broken only by a small belt of oases along the foot of the mountains, and a few poplars, willows, and reeds beside the larger rivers. The Ferghana valley is totally different. It is studded with a succession of flourishing settlements, and, pear-shaped in outline, is connected with Aralo-Caspian hollow only at its narrow outlet at Khojent.

Hydrography.

The form of the relief naturally conditions the drainage of the country. The rivers may accordingly be divided into two classes, namely, rivers, or reaches of rivers, running in a longitudinal direction down the eastern and western slopes from the interior of the mountain system, that is in the direction of the main lines of folding—in the eastern part west-north-west to east-south-east, in the western part east by north to west by south; and, secondly, rivers flowing down the outer slopes to the skirting deserts and steppes, and from the higher southern to the lower northern districts. Owing to the greater development of the Tian-shan in a longitudinal direction the former class are the larger and carry more water.

In both cases the type of drainage is purely continental, not a drop of water finding its way direct to the ocean. All the water is carried into lakes, or evaporates among the loose detritus at the base of the mountains. Consequently the rivers may also be classified as lake rivers and vanishing rivers of the steppes. To the former class belong almost all the rivers running in the longitudinal direction of the mountains. The broader and loftier western parts, and the more favourable climatic conditions of the ranges opening out westwards in a fan, have given rise to the greatest lake system of the Tian-shan—that of the Naryn, of which the main stream, called outside the Tian-shan the Syr-daria, discharges itself into the Aral Sea. The greater part of the drainage of the western Tian-shan is carried into this lake. The second large lake which owes its existence to the Tian-shan is the Balkash, which lies to the north-west and receives the water of the Ili and its tributaries.

No great lake on the eastern side rivals the Aral and Balkash. The only sheet of water of any extent is the Bagrash-kul. It occupies a

shallow basin in the bed of the Khaidu-gol, which under the name of the Konche-daria continues its course to the pools and swamps of Lob-nor.

The vanishing steppe rivers are found singly—not grouped into a large system—on the northern slope of the Iren-khabirgan, on the skirts of the Bogdo-ola chain, on the Mechin-ola, on the Alexander range and Kara-tau, and on the southern slope of the eastern half of the Tian-shan.

Whatever may be the ultimate goal of the rivers, whether in lakes or steppes, they have all well-marked mountain and level courses. As long as they are within the mountains they carry abundance of water, being frequently swollen by affluents that descend from glaciers and snowfields which produce a very swift current when the snow melts in summer. But when the rivers leave the mountains they are soon lost if small and feeble, or they meander through the sand and detritus, changing their course whenever the water rises to a high level, and at length succumb to the dryness of the climate and the unfavourable soil.

Baron von Richthofen distinguishes in Central Asia central and peripheral regions, that is, those which have no outlet and those which drain into the sea. Of peripheral regions there is none in the Tian-shan. Only those called by Richthofen transitional regions occur. In fact the conditions in the Tian-shan often resemble those of pure peripheral regions. The river systems terminating in the Aral and Balkash lakes are nowhere else so fully developed except in those parts of Asia which are drained into the ocean, and thus they present a complete contrast to the central character of the southern and eastern sections of the mountains. The boundary line between these central and transitional areas is connected with the position of the watershed between the drainage areas of the Aral and Balkash on the one side, and of the Tarim basin and Dzungaria on the other.

This main watershed does not lie in a straight or curved line, but follows a capricious, zigzag course. Normal watersheds run along the highest ridges, erratic watersheds forsake these for inner ranges of lower altitude, and degrade the loftier outer chains to secondary watersheds. One is inclined to suppose that the latter case is found in the Tian-shan, when one sees how far the head-waters of the Ak-sai penetrates into the chains south of Issyk-kul, and such a conception would be justified if the Ak-sai really broke through the Kokiya range, 15,700 feet high. But the Kokiya more probably comes to a sudden termination on the edge of the Tarim basin, and allows the Ak-sai to pass out comparatively unimpeded. Farther on the watershed jumps back eastward to the drainage basin of the Sary-jas, being probably determined by the escape of the drainage southwards to the Tarim basin through the gap between the Sary-jasy and Bor-koldai ranges. Then the main watershed passes on eastwards to the Narat mountains, bends sharply round to the west along the Iren-khabirgan chain, and is continued by the crest of the Dzungarian Ala-tau and its eastern prolongation. In its last section it ceases to form the watershed between the Aralo-Caspian and Tarim basins, dividing the Balkash basin from the Dzungarian desert, but throughout its course it forms the boundary

between the central and transitional regions, according to Richthofen's definition of these terms.

There are also a number of secondary watersheds, of which the most interesting are those transverse ridges left by the erosion of two longitudinal streams flowing in opposite directions. Such are very common in the Tian-shan, especially in the Dzungarian Ala-tau, the Irenkhabirgan, and the Trans-Ili Ali-tau. They are in no case independent parts of the mountain system produced by folding, but are simply formed by erosion.

Though little information is to be had with regard to valley formation, it seems evident that the great longitudinal valleys of the upper Naryn, Tekes, Kash, Kunges, Ili, and Kebin are true synclinal valleys. The longitudinal valleys are of two kinds, namely, those which lie at a low relative elevation and are drained by rivers which flow beside the outer chains direct into the lowlands without breaking through a range, and have excavated their beds in the old bed rock or the older Palæozoic sediments; and secondly, such as the valleys of the Naryn highlands and the Yuldus plateaus, with bottoms at a considerable elevation, sinking but little below the surrounding crests, and containing river beds washed out of the loose boulder and detritus accumulations of recent origin.

The later deposits of these broad high valleys are of especial value in showing the history of the valleys of the Tian-shan. Severtsof speaks of recent stratified deposits covering the bottoms of the broad valleys between the ranges of the Naryn district, and considers them to be of lacustrine origin. Richthofen who, when he wrote his first volume of *China*, knew only of Semionof's observations of unstratified loam and sand on the Jalanash plateau, holds them to be of the nature of löss, often mixed with detritus, and concludes that in the Tian-shan these deposits are chiefly the products of sub-aërial denudation. But the deposits in the Naryn highlands repeatedly described by Severtsof as exhibiting well-marked stratification can scarcely have been produced by atmospheric forces without the help of water, though these forces may also have played their part, contributing to the formation of what is known as lacustrine löss. At any rate, with our present knowledge, the existence of lacustrine deposits in the Naryn highlands cannot be denied offhand.

These indications of the former abundance of lakes in the Tian-shan are of importance as explaining the formation of the transverse valleys. The valley of the Koijerty is probably the result of the outflow of the water of the Son-kul over the lowest part of the edge of its basin, and the sinking of the surface of the lake is a consequence of the gradual deepening by erosion of the bed of the stream. In a similar way, most probably, the breach was formed by which the Atbash reaches the Naryn, and the Taushkan-daria was connected with the outlet of an old lake which has left its traces in the deep lacustrine deposits of the Ak-sai valley. Of the Little Yuldus valley, Przhevalski remarks that "in all probability this caldron-shaped valley was at a remote geological epoch the bed of an alpine lake, as the alluvial clay soil, besides other

facts, indicates." Whether the breaches of the Yuldus as well as of the source-region of the Balgantai-gol, described by Regel as an elevated steppe valley, are due to similar outflows from lakes, must be proved by future investigations.

The largest mountain-lake of the Tian-shan, the Issyk-kul, lies between the Naryn highlands and the Trans-Ili Ala-tau, and is preserved from completely drying up by peculiar circumstances and by the abundant water that pours down from the adjacent heights. Its basin is of tectonic origin, being a hollow between parallel ranges of mountains. At the present time without an outlet and impregnated with Epsom salts, the water must formerly have stood at a higher level, as shown by plainly marked terraces on the banks of red ferruginous clay, whence the Mongolian name Temurtu-nor or Iron Lake is derived. The evidence of these terraces seems to be contradicted by the remains of a settlement below the water at the mouth of the river Tub at the east end of the lake. The river may have carried away the bank with the remains of the walls, or the eastern end of the lake may have sunk. At any rate it is impossible to entirely deny the change of level, especially as the former outlet of the Issyk-kul to the Chu river is no longer used. Humboldt and Semionof remarked on the part the lake must have taken in the formation of the deep Bom ravine between the Alexander range and the Trans-Ili Ala-tau, and Mushketof has lately maintained again the hypothesis of an outflow through the Bom ravine. As long as the lake was drained in this direction the basin of the Kochkar, the upper course of the Chu, may likewise have been occupied by a lake, as the recent sedimentary deposits would lead one to suppose. But when the water burst through the barrier of the Kyzyl-ombol chain, the outlet of the Issyk-kul, owing perhaps also to the growing dryness of the climate and the sinking of the east part of the lake, became dry. This explanation is supported by observations of many kinds. The belief of the natives that the apparent excess of water carried into the lake above the amount removed by evaporation is drained off by subterranean streams is not surprising, but there is no evidence whatever that such an outlet exists. It is true, however, of the Sairam-nor, between the Dzungarian Ala-tau and the Iren-khabirgan chain. The sources of the large rivers in the neighbourhood all lie at the level of the surface of the lake or below. Their water is slightly saline like that of the Sairam-nor, and it is evident that infiltration takes place through the thin porous strata of limestone. The Chatyr-kul is not drained in any manner.

Geology.

Besides metamorphic schists and older and later eruptive rocks, the following formations occur in the Tian-shan :—Silurian, Devonian, Carboniferous, Triassic, Jurassic, Cretaceous, and Tertiary.

Granite, syenite, and syenitic porphyry apparently form the basis of the loftier ranges, and on the flanks of the granite masses are found nearly everywhere strata of mountain limestone. The axis of these granitic mountains is most frequently east-north-east or east by north

that is, one of the main directions of the chains. On the route from Kurla to Urumchi Bogdanovich has lately found numerous granite outcrops associated with sedimentary strata in which are faults running north-west to south-east and west-north-west to east-south-east—opposed to the general strike in the west but in harmony with the prevailing arrangement of the mountains in the eastern part of the Tian-shan. The quartz-porphyry seems to be later than the granite. In the Trans-Ili Ala-tau, where the rocks are much disturbed, it seems to be connected with the subsidence of the northern lowlands.

Azoic schists combined with old quartzites and micaceous sandstones have greatly contributed to the building up of the Trans-Ili Ala-tau, the Dzungarian Ala-tau, the Naryn highlands, the Alexander chain, the Irenkhabirgan and Bogdo-ola. Whether any of these, for the present classed as azoic, belong to the Cambrian or Silurian formations must be left for more thorough investigation to determine. Only at two points, far distant from each other, near Khojent and Viernoie, is the age of a compact micaceous sandstone apparently fixed as Silurian by the presence of *Leperditia* and trilobites.

Devonian rocks are clearly indicated by their fossils between Viernoie and the Balkash lake, round the Issyk-kul and the river Chilik, and on the flanks of the Kara-tau. Bogdanovich, geologist of the Pievtsof expedition, has examined the section between Chatyr-kul and Kashgar, and the fossils he collected have been pronounced by Professor Frech to be characteristic of the Middle Devonian beds, closely resembling the fossils of western Europe. Hence Frech was led to infer that the European deposits of the Devonian horizon were laid down in a sea which gradually extended into Asia, and Bogdanovich from the lithological and palæontological development of the Devonian beds in the western Kuen-lun and eastern Tian-shan, independent of the European conditions, also concluded that they were due to a sea which slowly spread eastwards into southern China. This correspondence of the Middle Devonian in the Tian-shan and the western Kuen-lun (Akka-tagh, Altyn-tagh and Russian range) gains additional importance by the latest researches of Ludwig von Loczy. Apparently the Devonian system is not represented in the greater part of north China and in the middle and eastern Kuen-lun, while it occurs in Kan-su, Se-chuen, and extends into south China (Fu-kien). Therefore the Nan-shan and eastern Kuen-lun must have risen above the Middle Devonian sea, and consequently the Altyn-tagh of the western Kuen-lun, with the same strike (south-west to north-east), belongs to the Tian-shan system or, at any rate, is of the same age, and younger than the middle and eastern Kuen-lun. These conclusions seem not improbable, though both Bogdanovich and Wegener regard the three sections of the Kuen-lun as forming a connected whole.

In the Carboniferous period a sea must have covered the surface similar in character to that of Devonian times, especially in the close approximation of its fauna to that of European Russia and the resemblance of its formations to those of northern India and parts of the Kuen-lun and China. Mountain limestone has been found on the

northern slope of the Kara-tau as far as the Iren-khabirgan, in the source-region of the Chirchik and Uigam, south of Issyk-kul and round Khan-Tengri, south of Chatyr-kul and round the Sairam-nor. Bogdanovich noticed it at the foot of Bogdo-ola, and it will no doubt be discovered elsewhere in the eastern part of the Tian-shan. The upper and lower divisions of the Carboniferous series are clearly distinguished, and both horizons have been also determined in the Koktan range.

After these beds had been deposited conformably on the Devonian strata the whole succession of rocks was convulsed by violent movements of the Earth's crust, for the azoic schists, Silurian, Devonian, and Carboniferous beds are much dislocated and contorted, being steeply tilted, folded and bent, and even reversed. The faults lie east-north-east and east by north, the still prevailing directions of the mountains in the western section. Whether in the eastern section the faulting runs west-north-west and west by north is uncertain, but it seems probably from the observations of Bogdanovich between Kurla and Urumchi. Probably after the coal period the site of the present Tian-shan was occupied by lofty ranges, for from that epoch through the whole Mesozoic age there was dry land here, over which the sea ceased to advance, penetrating only into the bays and valleys.

This arrangement of land and water is reflected in the Triassic and Jurassic deposits. Whereas the marine Trias at the pass of Ak-tash in the eastern Pamir indicates by its fauna the existence of a sea extending over all Eurasia from the Mediterranean to the Sunda islands, the Trias and Jura beds of the Tian-shan give absolutely no evidence of a sea, but rather tend to show that dry land existed for a long period with lagoons along the coast. The highest Triassic horizon, the Keuper, was noticed by Mushketof in the neighbourhood of Kulja. It contains specimens of *Equisetum arenaceum* and other plants. Above it lie a compact clay and calcareous sandstone, also containing plants and rich seams of brown coal but not a single marine mollusc, which almost without doubt belongs to the Lower Jurassic. Neumayr, indeed, maintains the existence of a Siberian Jurassic sea which by the "Tian-shan straits" across the Iren-khabirgan was connected with a Jurassic sea of the Tarim basin. He cites as the chief proof of his view some doubtful belemnites collected by Regel in the Iren-khabirgan range, and for the Tarim basin his proofs have been vigorously contested.

Seams of brown coal occur on the Kara-tau, Alexander mountains, Iren-khabirgan and the Bogdo-ola chain, and above all in the great bays of Kulja and Ferghana. The most extensive and best known are those of Kulja. The basin extends for twenty-five miles from east to west and is covered in the centre, near the Ili valley, by löss and recent conglomerate. The strata, 14 feet thick on an average, yield a very suitable coal for household use, and contain a supply sufficient to satisfy the demand for three hundred years. Through the carelessness of the natives some of the seams have caught fire, and for some years have filled the valley near Kulja with smoke.

The marine deposits of the Cretaceous period show a fresh encroachment of the sea. They appear, as marly clays, limestones, and con-

glomerates, on the western spurs of the Talas-tau, in the valleys of the Keles and Arys, and around the Ferghana beds, which are also partly Cretaceous. An arm of the sea stretched into the Tarim basin, but from the latest researches of Mushketof and Romanovski it seems to have been formed in Eocene times. How far the sea extended towards the east, and how long the sea connection with the Aralo-Caspian basin lasted, is still uncertain. Still more uncertain is another connection, assumed by Mushketof, in the region between the Terek-davan and the Suyok pass. If it existed, the Alai mountains must have risen as an island above the Tertiary sea, isolated by it from the rest of the Tian-shan.

The determination of the deposits of later age than the Eocene is rendered very difficult by the great scarcity of fossils. The later Tertiary rocks are very similar in lithological character and method of sedimentation in and around the Tian-shan. Tertiary beds are reported by Mushketof and Romanovski from the neighbourhood of Chimkent, the valleys of the Keles, Badam, and Chirchik, and in the Ferghana valley. Severtsof noticed similar beds on the meridian of the west end of Issyk-kul, in the valleys of the Ottuk and Char-karytma, on the passes of Dolonbel, Kyny, and Tur-agat, which he holds to be of marine formation, and remarks that their outcrops through the whole system between the Bom ravine and Kashgar show that where those sandstones were deposited a narrow sea extended across the saddles, so that the Tian-shan system has been formed by the union of several smaller systems. These are probably Lower to Middle Tertiary, for Severtsof remarks on their resemblance to the Kara-tau sandstones which lie on the coal-bearing Jura formation and must therefore be Cretaceous or Tertiary. The latter is the more probable, as shown by the researches of Mushketof, Abich, and others, and the light red sandstone and marly clay reported by Stolicza as lying over the Eocene strata of Sanyu, and especially on the southern slope of the Tian-shan between Chatyr-kul and Kashgar, seem to be of the same series. These deposits, named by Stolicza Artysh strata, have been known as the Han-hai strata since the deposits of the inland Asiatic sea of Tertiary times have been fully discussed by Fr. v. Richthofen. The resemblance of the later Tertiary rocks on the upper Huang-ho with the Han-hai strata observed by Pumpelly, Stolicza, Przhevalski, Obruchef and Bogdanovich in the desert regions of Mongolia and the Tarim basin, as well as with Severtsof's red sandstone and lacustrine deposits, appears the more important, because the palæontological discoveries of Loczy render it probable that, at least at the foot of the Nan-shan and on the upper Huang-ho, they are of Pliocene age, and have certainly proved them to have been laid down in lake basins. Therefore, in opposition to Obruchef's Tertiary sea, Loczy believes that Inner Asia, east of the Tian-shan region and the western Kuen-lun, has remained uncovered by the floods of the Han-hai since the expiry of the Carboniferous period. The solution of this problem will be a profitable task for the future. This much may be concluded at present—that in the Eocene period a sea covered only the western part of the Tarim basin, at times connected by the Alai, and possibly by the Chatyr-kul region, with the Ferghana basin and the ocean, and it seems also certain

that the separation from the ocean was accompanied by violent movements of the Earth's crust.

The different levels at which Tertiary beds occur indicate displacements of considerable extent. Thus the levels of identical strata in the Kyzyl-su valley (between the Alai and Trans-Alai) differ by fully 4900 feet, and the conglomerates of the Artysh chain compared with those of Chatyr-kul show a difference of 4600 feet. Probably both upheaval and subsidence have combined to produce this effect. Stolicza inferred a subsidence of the Kashgar plain from the disturbance of the Artysh deposits, and the same phenomenon is apparent in the flexures of the Han-hai strata north of the Turfan depression. The northern edge of Dzungaria is formed by the flexure of the Jair mountains, the southern by the flexures at the northern foot of Bogdo-ola. It is by no means improbable that the Ferghana basin has been involved in these movements, and that the Ferghana chain, so strange amidst the regularity of the Tian-shan lines, may be the elevated edge of a subsidence. Mushketof observed here two directions of strike in the marginal strata, a Chatkal-Alai strike running north-east to south-west, and a Ferghana strike in a north-west to south-east direction, and possibly in the Ferghana valley there has been a collapse along the two lines of fracture. At the same time the mountains gained in height during the Tertiary period by the process of folding. A second period of folding occurred in late Tertiary times which not only increased the elevation along the old east-north-east and east-by-north directions, but also contributed to the present conformation by raising ridges in a north-westerly direction. It is doubtful whether these new folds belong to a new and independent system. But, at any rate, in the west it seems probable from the nature and direction of the later faults that, just as in the Alps, a later folding in directions west-north-west to north-west runs across the older east-north-east folds. It is not impossible, however, that the eastern and western parts of the mountains differ in this respect. In the east the strata, including the Carboniferous, exhibit disturbances in a north-west to north-north-west direction, while the later Tertiary dislocations run east-north-east, which is an exactly opposite arrangement to that in the western Tian-shan.

That these north-westerly disturbances occurred in recent geological times seems to be indicated by the occurrence of eruptive rocks in the north-westerly ranges. Dolerite has been noticed in the Iren-khabirgan and near the meeting-point of the Ferghana range with the Alai, and especially south of Chatyr-kul. At the last place Stolicza discovered a Tertiary volcano, causing a revival of Humboldt's theory of active volcanoes in Central Asia. But the districts where, according to the Chinese notices collected by Ritter and Humboldt, volcanoes should exist, have been searched in vain, and Stolicza's remains the only known volcano in the Tian-shan; and that is extinct.

Climate.

Situated in the heart of the Asiatic continent, the Tian-shan has naturally a climate of extremes, colder in winter and warmer in summer

than that of Europe in the same latitude and elevation. In January the isotherm of 25° (reduced to sea-level) passes across the Tian-shan, while in Europe it lies well within the Polar circle. The central Tian-shan, in lat. 43°, has about the same mean January temperature as Hammerfest in lat. 70°. The January isotherm of 7°, which cuts the Tarbagatai, appears again to the north of Spitzbergen. On the other hand, in July the isotherm of 86°, which passes through the hottest parts of the Sahara, skirts the southern foot of the Tian-shan, and passes through the Ak-sai valley and the Chatyr-kul to Ferghana, while that of 79° lies at the foot of the Tarbagatai. The same large range occurs also in the temperatures of a single day. Przhevalski recorded, at Urungu in the Dzungarian desert, on April 8th, 73° F. at noon and frost at night, and Grum-Grzhimailo observed a daily range of 55° at Gashun.

Atmospheric pressure and winds are immediately dependent on temperature, and therefore they may be expected to exhibit a striking contrast similar to that which dominates the temperature. In summer a barometric minimum is produced in Central Asia owing to the heating of the air, while the cooling of the air in winter leads to a maximum. The winter maximum of over 30·55 inches lies to the north-east of the Tian-shan between Yakutsk and the Baikal lake, and the summer minimum of under 29·45 inches lies to the south-west of the mountains over the plateau of Iran. Owing to the distribution of pressure the winds in winter are chiefly east and south-east, while in summer west, north-west, or north winds predominate. The force of the wind is very great, especially in spring; and in accordance with the continental character of the region the force increases towards the middle of the day.

The moisture carried by the wind is condensed on rising up the slopes of the mountains, and falls as rain or snow. The result is that the Tian-shan forms a moist island in the midst of dry steppes and deserts. The annual amount of rain varies from 10 to 20 inches, which Supan defines as moderate. The relative humidity is low, but the absolute humidity, even in the dry regions around the Tian-shan, is not inconsiderable; and the July mean in Turkestan, Tashkent, Marghilan, and Yarkand is as high as in Vienna and Paris. The west, north-west, and north winds, which are the rainy winds especially in summer, cannot possibly derive all their moisture from the distant ocean, but must be supplied to a large extent by the swollen waters of the rivers and the Caspian, Aral, and Balkash lakes. The Tian-shan has a very different character on the side exposed to those moisture-laden winds from that which marks the lee side. Hence the contrast between the dry southern flank, clothed with scanty vegetation, and the better-watered northern flank, and the dryness of the eastern portion compared to the more favoured western part which spreads out towards the direction of the rainy winds.

These climatic conditions have left their mark on the mountains. The extremes of temperature have caused an enormous amount of degradation, especially noticeable on the northern and western slopes. All the appearances which have attracted notice since Walther's study of

desert-denudation in the Sahara are to be found here, and the scantiness of the vegetation has assisted the atmospheric forces. This, again, is dependent on the rainfall, the northern slopes exposed to the rainy winds being better clothed than the southern. As elsewhere, the löss in the Tian-shan owes its origin and distribution to atmospheric agents. It covers the northern and western slopes in thick layers, and is the cause of the fruitfulness of the northern oases, while it also occurs in the interior and east of the mountains. The worst foes of this fertile district are the sand dunes, which, driven by the wind, are ever encroaching on the small strip of fertile land along the foot of the mountains; and all parts of the system appear to be drying up. This is shown by the shrinking of the lakes and the presence of old moraines where the glaciers have receded owing to a diminution in the rainfall.

THE SEVENTH INTERNATIONAL CONGRESS OF GEOGRAPHERS.

Looked at from a scientific point of view, the Geographical Congress which recently met at Berlin cannot be said to present any feature of outstanding importance. As was pointed out by one prominent speaker, and echoed by many, the time is now past for sensational discoveries on the earth's surface. Every bit of the globe is known to civilisation, and only small fragments remain unconquered by the implements of survey. What remains to be done is not the work of explorers so much as of specialists in different branches of *Erdkunde*—like geologists, meteorologists, oceanographers, ethnographers, and students of natural history.

A very short summary is all that is necessary to make Scots geographers acquainted with the "proper" work of the Congress; though it would take more space than is here available to make them understand and appreciate the graceful and overwhelming hospitalities accorded to the members by their German hosts. If there was one dominant note in the proceedings it was that of Polar Exploration, and this, perhaps, as much owing to the commanding personality of the speakers as to any absorbing interest in the subject itself. A Highland chief, asked to move to the head of the table, is said to have replied—"Where M'Nab sits is the head of the table!" And it is no exaggeration to say that what Nansen did or said was the constant centre of attraction. Eminent as other members, German and foreign, might be, he was the pivot of the Congress. His presence at a meeting or a festival, a few words from him in a discussion, lifted it at once into importance; and everywhere groups showed a tendency to gather about him, as if the glamour of his wonderful enterprise and hardihood still enveloped that frame of supple steel.

The place of honour in the programme was given to a paper by Professor Chun, on the Deep Sea Expedition of the German ship *Valdivia*, and nothing could have been more hearty than Sir John Murray's repeated recognition of the valuable work of this latest successor of the *Challenger*. Next came a report on an expedition in the waters of East Greenland, by the Prince of Monaco, who attended the Congress with unflagging constancy, and evidently with unwearied interest. Besides these, there were read the first afternoon a wonderful medley of contributions, ranging from an English paper on the very practical subject of tea-plant

distribution to an essay from a Russian savant "on the relation which exists between the repartition of the magnetic elements and the surface of the globe's mean temperature." Most popular, because most human in its interest, was the Anthropogeographical Section, at least two papers in which might have figured more appropriately in a Congress of Antiquaries—one on the plans of Ancient American cities, and another on the cyclopean monuments of Ceylon. That was on Thursday, and next day, both at the General Meeting and in A section, most of the hours were devoted to Polar Exploration. Reserving his own paper for another evening, Nansen entered the tribune to discuss the views advanced by Sir Clements Markham on Antarctic Expeditions. Nothing is more remarkable about the Norwegian hero than his ease and charming manner as a public speaker. Entirely unembarrassed, full of his subject, enthusiastic in his tone, the words he needs at the tip of his tongue, with a facile play of arms and hands, he captivates his hearers from the very beginning, and never loses them till he has said what he wants to say, and then stops at once, abruptly, like the sailor that he is. Sir John Murray was listened to with almost equal attention, and not the less because he thought it his duty to differ with several speakers as to the order of procedure in exploring the South Pole. Sir Clements was for instant attack, while the Scots delegate preferred to "gang warily," and advocated a careful survey of the Antarctic Continent before aiming at the pole itself. Though he sometimes ventured on German, Sir John spoke mostly in English, and many were the compliments he got for the slow and considerate articulation which made him easy to follow by all who knew English fairly, while other English speakers by their hasty and careless speaking were seldom or never understood. There was the same merit in the Prince of Monaco's French, which was clear, unhurried, and deliberate—a pleasure to listen to. A bare catalogue of the other subjects of discussion would serve no purpose here. Suffice it to say that they embraced numerous papers on international units and methods of measure, on Geographical Education, on Geomorphology, Oceanology, Travels, Chorology, Cartography, Glacial Action, and Geodesy. Are not all these to be printed in the book of the chronicles of the Congress?

Among the seventeen resolutions adopted by the Congress, were—(1) the appointment of an international commission for the organisation of meteorologic magnetic work in connection with Antarctic Expeditions; (2) the universal use of metrical weights and measures in scientific work with the retention of the present divisions of time and also, in the meantime, of the divisions of the degree; (3) the establishment of an international seismic society and the constitution of an international commission for the study of earthquakes; (4) an appeal to the various governments concerned to carry out the resolutions of the Oceanographic Conference held at Stockholm in July last; (5) the fitting out of an expedition to search for the remains of Leichhardt, who was lost in the interior of Australia in 1848; (6) the execution of a map of the world on the scale of 1:1,000,000; (7) the approval of the Danish Meteorological Institute as a suitable centre for the study of drift-ice.

A notable contribution from Scotland was a paper on "The Basins of Southern Europe," in which Mrs. Ogilvie Gordon enunciated original views on rock-torsion, which gave rise to an interesting and animated discussion.

In these chronicles, however, the one grand and shining characteristic of the Congress is not likely to find a record. I mean the keen enthusiastic geographic spirit which pervaded it from beginning to end, and the high distinction accorded to its work by the imperial and royal, not less than by the political and learned, potentates of Germany. The opening ceremony was impressive and significant.

The scene of the Congress's operations was the new Palace of the Prussian House of Commons, the whole of the vast building being open just as it is when the Chamber is sitting—servants, ushers, and all. Ladies had the use of the President's rooms, the salon a work of art in old German wood-carving of the finest period. The chamber itself was used for general meetings and big occasions, while the various sections were accommodated in committee-rooms. In the reading-room members had the choice of what seemed hundreds of newspapers; and indeed every want that could be anticipated was handsomely provided for. At the ceremonial opening the spacious chamber was seen to great advantage. Instead of sombre rows of solemn deputies, there were groups of princes, diplomatists, cabinet ministers and military men in gorgeous uniform, with a plentiful sprinkling of ladies whose scientific or blue-stocking proclivities had not apparently diminished their preference for bright and fashionable attire. What may be called the "Speaker's" chair was filled by Baron von Richthofen, President of the Congress, *langjährige Präsident der Gesellschaft für Erdkunde*, and the Nestor of Geography in Berlin University. Nothing could exceed the urbane and genial dignity with which the learned baron discharged his duties; and perhaps a word of thanks may be permitted here to the Baroness and to her niece, the Fräulein von Jacob, for their unwearied efforts to ensure the comfort and happiness of lady-members. If a hundred of their fellow-countrymen who worked hard for similar objects are left unmentioned, it is not because their courtesy was unobserved, or their patience unappreciated.

Supporting the President, in the gallery for distinguished persons, were Prince Albrecht (representing the Emperor) the Prince of Saxe-Weimar, Prince Hohenlohe (Chancellor of the Empire), the Minister of Education, the Prince of Monaco, the still unconfirmed Burgomaster of Berlin, Sir Clements Markham, and Sir John Murray—representing the Royal Scottish Geographical Society. The two German princes, both splendid specimens of their race, and both six feet at least, wore bright blue military uniforms blazing with stars and medals. It was *de rigueur* that men should turn out either in uniform or evening dress, with all their decorations; and the result was dazzling. One venerable and gallant savant from St. Petersburg was so covered with chains, ribbons, and pendants as to suggest a perambulating jeweller's-window, and others sported from say a dozen decorations down to one—the very elegant enamelled badge presented to every member on arrival.

In a few sentences of soldierly precision, His Royal Highness ("in the name of our beloved Emperor") declared the Congress open, after which speeches were made by Chancellor Prince Hohenlohe, the Minister of Education, and the Mayor. There was no room for doubt concerning the importance attached to the Congress by the ruling powers in Germany. Their serious attitude towards geography was borne in upon one from beginning to end—a result apparently of their persuasion that a knowledge of the earth's surface, of its riches, its races, its commerce, its needs, and its accessibility, is bound up with their own prosperity and ambitions. In spite of many social counter-attractions, the meetings were well attended; and when Baron Richthofen bade his guests farewell, there were as many present as when he made them welcome.

These pages are perhaps not quite the place to chronicle *mondanités*, but, inasmuch as the social reception given to the Congress by their German entertainers is a measure of the importance they attach to it, an outline of the festivities may be ventured on. Not to be omitted was the unpretending but hearty reception of Cologne geographers to foreigners on their way to Berlin—a truly cosmopolitan and polyglot gathering of about five-and-twenty. Before I left

I had heard speeches in five different languages; and my neighbour, a Soudan explorer, was threatening to contribute a sixth in Arabic! If a Britisher with a smattering of French and a smattering of German wishes to feel linguistically humiliated, let him attend a Geographical Congress in Berlin. In languages, and in the application of science to industry, Germany is unmistakably ahead of us; and the sooner we realise it the better. Probably the highest mark of distinction paid to the Congress was its reception by Prince Hohenlohe, when the spacious state-rooms of the Chancellor's residence were thrown open to foreign delegates. Of these rooms the finest is that in which the famous Berlin Conference was held, from which Lord Salisbury and Mr. Disraeli brought "peace with honour." Its tables were laden with *Abendessen* delicacies, and the Rhine had been put under tribute for its generous vintage. What seemed to us Britishers an odd incongruity was a huge dirty beer-barrel set on its end in a corner of the salon, from which two gorgeous lackeys did nothing but fill beakers which others equally gorgeous bore among the guests on silver trays. But it was equally a feature of all the grand receptions which followed; and we were assured that even in the Kaiser's palace the big and grimy cask fresh from the brewer's dray is rarely wanting. *Seine Durchlaucht* had not quite finished the labours of receiving his guests when a copiously decorated officer arrived with a despatch from the Kaiser. After carefully reading it, the Prince signified his pleasure that it should be read aloud; and those in the vicinity had the gratification of listening to one of the German Emperor's telegrams—a missive with associations not always agreeable to a Britisher! It was a gracious welcome to the geographers, couched in those direct, virile, and hearty terms which Wilhelm II. has always at command. In the Chancellor's writing-room there were various evidences of his Imperial master's favour—portraits and signed proofs of the Kaiser's own metaphorical pictures—rare and precious. Paul's bodily presence was not more weak than Prince Hohenlohe's. Short even among little men, he is rendered undignified in his movements by a stiffness which keeps his head to one side, and compels him to move the upper part of his body in one piece. But his face beams with intelligence, his voice is soft and sympathetic, and his expression must owe its charm to a natural kindliness, though astuteness undoubtedly predominates. A good friend and a dangerous enemy!

For open-handed, almost prodigal, hospitality the banquet given by the Municipality of Berlin on Saturday, the last night of September, could hardly be equalled. Tables for over 1100 guests were laid in the "feast-saloons" of the Zoological Gardens, each table being adorned with festoons of flowers carried by an electric wire supplying coloured lights every 10 or 12 inches. Some idea of the viands may be formed from the fact that 1200 partridges were ordered for the feast, a whole bird being served to each guest; and there was just as little stint of wine. If anything, it was perhaps too Gargantuan, but it was the jolliest and most genial of many scores of banquets it has been my privilege (or fate!) to attend. Before German gentlemen sit down amongst strangers, they bow to those near them and exchange names—a considerate and sensible custom which takes the edge off the feeling of newness. Each table was in charge of a town-councillor, whose duty seemed to be to run up and down behind his guests seeing that they fared sumptuously and drank fairly. To resist proffered oceans of hock, I was constrained at last to quote Coleridge—

> In Spain, that land of monks and apes,
> A thing called wine is often made from grapes;
> But on the noble river Rhine
> A thing called gripes doth often come from wine!

But our councillor had his answer ready, and was not to be denied—there was Bordeaux in abundance, with a German verse to match the English one—

> Ein Deutscher Mann kann keinen Franzmann leiden
> Doch seine Weine trinkt er gern.

which may be thus interpreted—

> No German heart can to a French incline,
> But Germans heartily can drink French wine!

Sunday was spent in excursions one to Rüdersdorf (geological) and another (much the biggest) to Potsdam, where Frederick the Great's palaces were exhibited in all their hideous rococo. Monday night saw us all in the Kaiserhof Hotel, guests of Berlin geographers, where Baron Richthofen gracefully discharged the duties of chief host, supported by dignitaries of every rank and complexion, princes, generals, admirals, statesmen, explorers and savants, all once more in full dress and decorations. To wind up their princely entertainments the Berlin people invited their visitors to a gala-performance of Wagner's "Meistersingers," when the Royal Opera House was filled by members of Congress, ladies and gentlemen being for the most part separated as in ritualistic churches. I confess that there is far too much recitative for my taste. Several chance bits of melody, however, were very welcome, and the really lovely song "Morgen" was like the shadow of a great rock in a weary land. All the same, it was the best and highest treat Berlin could think of and was highly appreciated. When Nansen made his appearance at the door going out, I saw a surging crowd of young lads surround him, crying "Nansen, hoch!" not the least appropriate cry to close the last gathering of the world's geographers.

By Wednesday forenoon all pretence of work was over, and our motto was that of the Brussels ballroom, "Let joy be unconfined." So next day we surrendered ourselves to the generous citizens of Hamburg, hoping, rather than believing that we should survive the hospitalities in store for us. It was no longer a Geographical Congress but a Geographical Carnival—Hamburg kindly professing by way of excuse that, being a seaport, she owed everything to geography. From the time we stepped out of the train and were taken possession of by gentlemen with red and white favours we were veritable *enfants gatés*. In the "Raths Weinkeller," a famous banqueting-room in the crypt of the town-hall, we were brought face to face with a Brobdingnagian lunch, after which we were conducted through institutes of learning and museums; and were only given time to dress for a luxurious function in the new saloons of the new Rathaus, just completed at a cost of nearly one million sterling. In the principal state-room, the Mayor announced that it was now for the first time inaugurated by the learned Congress of Geographers, and closed by calling for cheers in honour of the Emperor, responded to by enthusiastic shouts of "Wilhelm, hoch!" from hosts and guests alike. Next day we were the guests of Hamburg from ten in the morning till midnight, if not later, ferried about the harbour and the firth in steamers, guided over shipbuilding works, entertained on Atlantic liners, and finally dinnered or suppered with still-increasing prodigality in a kind of sublimated tea-garden called "Bergfahrt in Tirol." Next morning we were all glad to turn our faces towards home and plain living, if not high thinking.

T. C.-B.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Meetings in November.

The Annual Business Meeting will be held in the Society's Hall, Edinburgh, on November 14th, at 3 P.M.

The Anniversary Meeting at Edinburgh will be held on November 16th, in the M'Ewan Hall, at 8 P.M., when Lord Charles Beresford, M.P., will address the Society on the Far East. Sir John Murray, K.C.B., will preside.

The Session will be opened at the Glasgow Branch by a meeting on November 22nd, at 8 P.M. Professor G. A. Smith, D.D., will speak on "The United States of To-day." Sir John N. Cuthbertson will preside.

The Dundee Branch will be addressed, on November 15th, by the Rev. James Scott, on Natal. The meeting will be held at 8 P.M.

Mr. Scott will also deliver a lecture to the Aberdeen Branch, on Nov. 14th.

GEOGRAPHICAL NOTES.

By The Acting Editor.

EUROPE.

Investigation of Northern Seas.—In the *Göteborgs Handels- och Sjöfartstidning* of September 20th, Professor O. Pettersson published a report of the arrangements made at the International Conference on Fisheries. A map shows the areas assigned to the nations bordering the Baltic, North, and Arctic Seas, in which each is to carry out simultaneous investigations at the beginning of February, May, August, and November, these being the months in which the greatest changes take place in the waters.

To Finland are assigned the Gulf of Bothnia and the Åland Sea. The Finnish senate has already approved of the establishment of six hydrographical stations on the coast for a period of five years, and since 1898 hydrographical and biological investigations have been pursued not only in the Gulf of Bothnia and the adjoining waters, but also in Lake Ladoga and the deeper lakes of Finland, simultaneously with the Swedish investigations in the Baltic and Lake Wetter.

The Russian inspector of fisheries, M. Grimm, said that investigations could easily be made in the inner part of the Gulf of Finland as far as Hogland from the Russian stations on the coast of Esthonia, while the deep basin of the Baltic east of Gotland might be sounded by revenue and pilot boats sailing from Port Baltic or Libau. The Barents Sea and the White Sea are also included in the Russian sphere. A branch of the Gulf Stream keeps the sea off the Murman coast free from ice in winter, and from the new Ekaterina harbour hydrographic and biological research may be extended into Barents Sea, and will be important in relation to the international observations in the Atlantic.

Germany's sphere of action will extend from Kiel westwards along the coast of Schleswig and eastwards along the southern part of the Baltic. For thirty years Germany has from time to time taken observations in the Baltic, and, under Professor Krümmel, took part in the first international investigation of 1893-94.

Besides a longitudinal section, the important cross section from Ystad to Arcona, first examined by Ekman in 1877, will be in charge of the German hydrographers. The area in the Baltic assigned by the conference to Sweden is very restricted in area, including, however, two very important stations, namely, the deep hollow east of Bornholm, and the deepest hollow in the Baltic, to the east of Landsort. Of late years the Swedish hydrographers have executed soundings, simultaneous with those in this deep basin, in the water-filled mine of Utö and in Lake Wetter, in order to ascertain what amount of heat is due to solar radiation and to sea currents, and its propagation downwards. In this work the Swedish scientists have worked in combination with those of Finland and Norway, where temperature series have been obtained in Mjösen, Ladoga, Lojo, Päiäne, Enare-träsk, etc.

Sweden and Germany have also received areas in the North Sea. The German lines of stations begin at Heligoland and cut the eastern part of the Great Fisher bank and the Norwegian depression in two places. These are the lines investigated by the German *Drache* expedition in 1883 and 1884. The Swedish area is situated in the Skagerack. The other side of the North Sea is to be investigated by Great Britain and Holland, the latter working across the mouth of the British Channel and across to the western parts of the Dogger bank, while the British lines also run to the Dogger bank and the fishing waters west of the bank (the Silver Pits, for instance). Thence they run to the Moray Firth and across the northern North Sea plateau to the Norwegian channel, turning then northwards of the Shetlands to the Färoes and south to the Rockall banks in the Atlantic. The influence which the water masses flowing over the Färö-Shetland channel exercise on the hydrography and fisheries of the North Sea have been frequently pointed out in these pages. The Danish investigations between the Färoes and Iceland will throw light on the behaviour of the Gulf Stream and the Polar current at their meeting-points. To Denmark is also assigned the task of observing the Kattegat from the Skaw to the Great Belt.

The Polar stream in its more distant domain falls to the share of Norwegian hydrographers. Their lines will run across to the east coast of Iceland, thence to Jan Mayen and back to Lofoten. These lines will be traversed in spring and autumn, and, when possible, in February.

These observations in vessels will be completed by observations at fixed stations on the coasts and islands, and at lighthouses and lightships.

The method of observation will be the same as that of the Swedish hydrographers. The choice of stations is left to the experts of each country, and these once chosen will be adhered to for all future investigations. Currents will be examined both by floats and direct observations from anchored vessels, and the bottom currents by the use of "bottom-rollers," balls of glass weighted so as to sink in sea-water, which after rolling about on the North Sea plateau will be recovered in the nets of trawlers. Microscopic organisms will receive special attention and be so carefully weighed and measured that some estimate may be obtained of the quantity of fish that can find sustenance in the waters. The conference also resolved that the researches shall not only illustrate the hydrography of the sea and the conditions affecting fisheries, but be useful to the meteorologist and assist in the forecasting of weather. Professor Pettersson's articles on the relation of the temperature of the surface waters and the climate of northern Europe have already been noticed in vol. xiv. p. 369. And now Professor W. Bjerknes has propounded the theory that all the movements of the atmosphere and sea can be most simply calculated by ascertaining the prevailing pressure and density at certain points at different levels of the ocean and atmosphere. Therefore the vessels engaged in research work should be provided with

self-registering instruments which can be raised up by kites and show the pressure and density at different heights in the atmosphere, just as soundings obtain the pressure and density in the various layers of water. Thus isobars and lines of equal density can be drawn, cutting one another like the meshes of a net. Where the meshes are closest, there is a centre of force in the water or atmosphere, and the number of meshes within a certain area is a measure of the kinetic energy producing storms and currents. At present this theory is open to doubt, and the observations in the North Sea will serve to confirm or disprove it.

The biological observations will extend over all branches of investigation which deal with fish life and the methods of fishing, the eggs of pelagic fish being carefully studied, especially with reference to the density of the water.

It was also resolved by the conference that it is expedient to establish a central institute, the functions of which should be (*a*) to draw up uniform instructions for hydrographical and biological work; (*b*) to control the apparatus and ensure uniformity in the methods of research; (*c*) to carry out any special investigations which may be relegated to it by the co-operating countries; (*d*) to publish periodical reports and bulletins; (*e*) to fix common standards and scales, etc.; (*f*) to repeatedly test, in connection with the telegraph departments, the electrical resistance of submarine cables, which furnishes the surest means of observing small changes of temperature at the sea bottom. The expense of the institute was estimated at £4800, and would be distributed among the participating countries, the greater quotas being paid by Great Britain, Russia, and Germany.

Belgium and France did not send delegates to the conference, alleging as a reason that their interests were chiefly in the fisheries of the English Channel and the Atlantic. If the programme sketched by the conference is carried out, it is hoped that combined investigations may be extended to these seas also, and indeed still further, and that then France and Belgium will do their share.

The Climate of Jersey.—The Rev. H. W. Yorke, who has resided in the island for twenty years, read a paper on its climate before the Meteorological Society in March (*Quarterly Journal*, No. 111). The shape of the island is roughly rhomboidal, the north and south sides being each about 11 miles long and the west and east 5½ miles. The area is about 45 square miles. The surface is a plateau sloping from north-west to south-east and intersected by nearly parallel valleys, along which nearly all the drainage is carried to the south and south-east coasts. The greatest altitude of the plateau is 480 feet on the north, and 175 feet on the south-east.

The ordinary spring tides vary from 33 to 41 feet, and the mean annual temperature of the sea-water near shore is 54°, or 2° above the mean air temperature. This high temperature of the large masses of water passing the island has no doubt a marked influence upon the climate, especially during winter and summer.

The mean barometrical pressure in Jersey is 29·977 inches. It is remarkable that the full force of gales is seldom experienced, the force registered being 5-7 when 7-9 is registered with a radius of 150 miles. The rain amounts to 34 inches in the year; of this, by far the greater part falls between 6 P.M. and 6 A.M. The amount of sunshine, averaging for fifteen years 1930 hours, is a further proof of the absence of cloud and rain during the earlier part of the day. From 1881-86 some of the evening sunlight, and from 1887-88 some of the morning sunlight was not registered owing to the position of the recorder. Since 1888 the average has been over 1980 hours. But even the average 1930 is 2 per cent. more than the recorded sunshine in Guernsey, and 5 per cent. more than at the sunniest place on the south coast of England. The relative humidity of the air is high, averaging

82 per cent., which causes the extremes of temperature to appear to the senses greater than they really are.

The annual shade temperature, as already stated, is 52° ; the mean maximum and minimum are 57° and 47°. January, the coldest month, has a mean of 42°, and August, the warmest month, of 63.° The mean temperature of the sea-water ranges from 40° in December to 60° in August. The number of rainy days is 190 on an average.

In the discussion which followed the reading of the paper doubts were thrown on the force given for the wind, on the ground that St. Aubin's, where the observations were made, is a particularly sheltered spot.

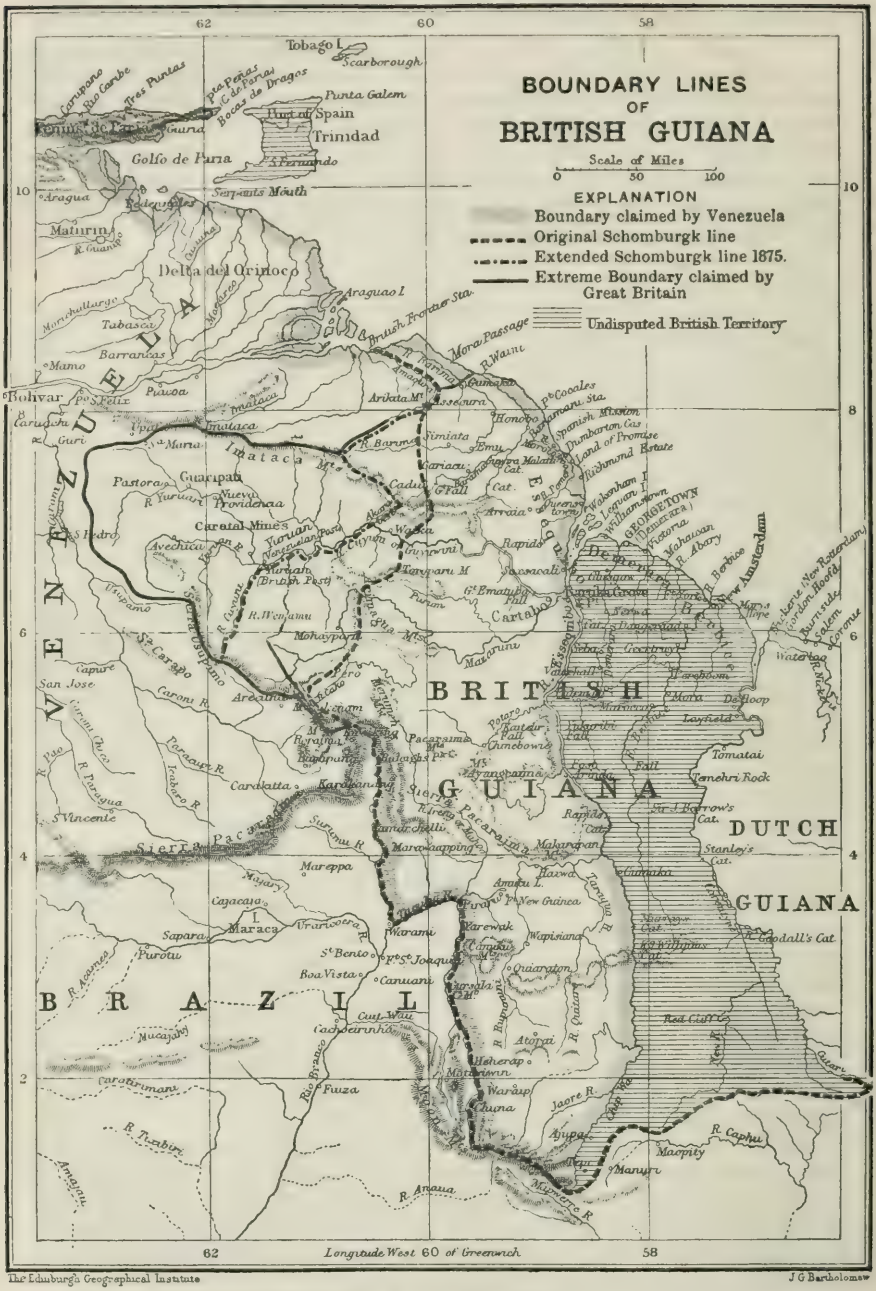
AMERICA.

The British Guiana Boundary.—The award of the tribunal of arbitration was given at Paris on October 3rd. The text of the award defines the boundary between British Guiana as follows:—"Starting from the coast of Venezuela at Point Playa, the line of boundary shall run in a straight line to the confluence of the river Barima with the river Muruma, and thence along the mid-stream of the latter to its source. From that point it shall proceed to the confluence of the river Haiowa with the Amacuru. Hence it shall follow the thalweg of the Amacuru to its source in the Imataca ridge ; thence towards the south-west it shall follow the highest ridge of the spur of the Imataca mountains opposite to the source of the Barima, and then the principal chain of the Imataca mountains, south-eastwards to the source of the Acarabisi creek. It shall follow the thalweg of the Acarabisi to the Cuyuni, then the northern bank of the Cuyuni towards the west, as far as its confluence with the Wenamu ; then the mid-stream of the Wenamu to its most westerly source ; thence it shall take a straight line to the summit of Mount Roraima, and from there to the source of the Cotinga, which river it shall follow to its confluence with the Takutu. Ascending to the source of the Takutu the boundary shall run straight to the most westerly point of the Acarai mountains, then follow the crest of the Acarai mountains to the source of the Cutari, the upper course of the river Corentyn, which forms the boundary to the sea."

Thus it will be seen that the new boundary deviates little from the Schomburgk (1875) line. In the north, instead of following the Amacuru to its mouth, the new boundary ends at Playa point on the western side of the mouth of the Waini, leaving the swampy patch of country, about thirty square miles in area, through which the lower Barima flows, to Venezuela. The mouth of the Barima, by which vessels can enter the Orinoco from the Mora passage, lies therefore within Venezuelan territory, but it is decreed that navigation on the Amacuru and Barima shall be free to the ships of all nations, and that the custom dues levied at the Venezuelan and British ports on these rivers shall be the same and no higher than those levied on goods carried in ships of other countries. No customs are to be levied on goods merely carried along these rivers.

In the south the boundary, instead of following the Schomburgk line to the source of the Cuyuni, ascends its tributary, the Wenamu, and thence proceeds to Mount Roraima, thus leaving a strip between the upper Cuyuni and the Wanema to Venezuela. South of Roraima no change in the boundary has been effected, but it is expressly laid down that the decision does not prejudice questions existing or which may arise regarding the Brazilian boundary.

Of the 60,000 square miles claimed by Venezuela, she has obtained about 200, and Great Britain retains the gold mines of the Barima and the whole basin of the lower Cuyuni.



The Edinburgh Geographical Institute J.G. Bartholomew

POLAR REGIONS.

Lieut. Peary's Explorations.—Last winter Lieut. Peary passed in Kane basin about 50 miles north of Cape Sabine, having been unable to reach Sherard Osborn fiord in lat. 82°, as he had intended. During the winter he made four excursions to Fort Conger in Grant Land, where Greely wintered, both for the purpose of exploration and also to make caches of provisions. With these supplies and other depôts which will be added, Peary will be able to begin the exploration of the north coast of Greenland, whether the *Windward* is able to land her stores at Sherard Osborn fiord or not.

Hayes Sound, which was supposed to extend westwards to the sea, cutting off Ellesmere Land from Grinnell Land, has been found to be only an inlet or bay. Mr. Peary travelled westwards across the northern part of Ellesmere Land and visited the west coast, connecting his survey with the strip of coast farther north which was discovered by Lieut. Lockwood, of the Greely expedition, in 1883. Also in his journeys northwards he skirted the east coasts of Grinnell Land and Grant Land for a distance of 250 miles, rectifying the mapping of the shore lines. The farthest point reached was Cape Beechy in about 82° N. lat. No effort was made during the past summer to push northwards, and Peary's winter quarters are established on the Greenland side of Smith Sound, several miles south of his quarters of a year ago. Here all the provisions of the *Windward* and all that the *Diana* brought out have been landed.

Dr. Stein and his party were landed by the *Diana* at Cape Sabine. Sverdrup in the *Fram* was frozen in near Cocked Hat Island, ten miles west of Cape Sabine. He intended this summer to work his ship up Kennedy Channel and land at some point for a trip across the north of Greenland.—*National Geog. Mag.*, October.

Meteorology of the Antarctic.—In continuation of his report on the meteorology of the Antarctic in *Ciel et Terre* (*see* p. 490), M. H. Arctowski deals in the number for August 16th with the pressure. The mean for the year was 29·32 inches, indicating a region of comparatively high pressure at the South Pole. According to Ferrel's calculations the pressure should be 29·66 inches at lat. 60°, 29·12 at lat. 65°, and 29·06 at lat. 70°. There is thus a difference of 0·26 inches between the actual pressure observed on the *Belgica* and the theoretical pressure, and the supposed diminution of pressure towards the Pole is no longer probable (*see* Dr. Buchan's remarks in *S.G.M.*, vol. xiv. pp. 527-530). The lowest pressure recorded was 28·02 inches, and the highest 30·4 inches, the absolute range being therefore 2·38 inches. The mean of the monthly variations was 1·34 inches, which shows that the region of storms extends beyond the Polar circle. A calculation of the variations of the monthly means from the annual mean shows that the pressure is below the annual mean in the months February to April, the difference in the last month amounting to 0·36 inches, while in the other months of the year it is above the mean. In May to July the pressure is at a maximum; a secondary minimum occurs in August to October, followed by a secondary maximum in November to January. Thus the pressure is highest at the solstices and lowest at the equinoxes, and there is a direct and very simple relation between the barometric pressure and the course of the sun.

In *Ciel et Terre*, October 1st, M. Arctowski concludes his sketch of Antarctic meteorology as observed on the *Belgica*. The prevalence of the winds for the year and individual months is shown by diagrams. There is complete equilibrium in the yearly diagram between northern and southern winds. The

most prevalent winds are the west, then the east, north-east, and east-south-east, the winds from the easterly directions predominating over those from the western. The monthly diagrams show that the various months of the year differ greatly as regards the prevailing winds. Especially noteworthy are the prevalence of north-east to south-east winds in the months November to February, and the frequency of west winds in the months June to August. It should be remembered that these observations relate only to a single year and to one small part of the Antarctic ice barrier.

M. Arçtowski remarks that though in general temperature is the most important factor in climate, yet that in the Polar regions the human frame is most influenced by the absence of the sun during the winter, while in summer the radiation of the sun is felt more than the temperature of the air. Nebulosity is therefore an important factor in the life of an explorer. Wind also has a great effect, a temperature of 4° F. being quite bearable in a calm, but penetrating through the thickest furs when the breeze is strong. The humidity, on the other hand, plays a secondary part, for at temperatures below 14° F., when the air is saturated with moisture and rime is freely deposited, the air that a man breathes seems quite dry. M. Arçtowski gives a table of actinometric measurements taken on December 30th 1898, and points out that at 2 p.m. when the temperature of the air was 31·6° F. the black-bulb thermometer marked 113·2°, showing the intensity of the solar radiation. But generally the sky was clouded, often with a dense layer of stratus clouds which made the whole sky grey for hours or days together, and sometimes was rarely broken for weeks.

The months February, March, April and May were the most windy, and October was also bad. During July to September and during the months of continuous daylight—November to January—there was a large proportion of calm weather. As shown in a table, there were 55 days of calm and 189 days of light breezes between March 1898 and February 1899, leaving 176 days on which the wind blew with force. Snow was recorded on 257 days and rain on 14, but these figures may not be very exact, for when the wind was strong it was not always possible to decide whether the snow was falling or was merely carried along the surface, and not always easy to distinguish between sleet and rain. M. Arçtowski adds a table of the number of nights in March 1898, and from October 1898 to February 1899, when the hygrometer fell to 90% or below, and also notes on the occurrence of rime. He sums up the weather as follows:—Little calm weather, sky very cloudy, frequent fogs, plenty of snow, humidity very high. A paper by the same observer is published in the *Geographical Journal* for October.

MISCELLANEOUS.

Among the articles in the *Annals of Scottish Natural History* for October are "On the Occurrence of Risso's Grampus on the east coast of Scotland," by Dr. Traquair; "Observations on the Birds of Tiree and Coll," by Colonel Irby; "Scaup Duck Nesting in Scotland," by Mr. Harvie-Brown; and "Notes on the Fresh-water Entomostraca of Aberdeenshire," by Mr. Thomas Scott.

Major Ronald Ross, writing from Sierra Leone, states that the results of his inquiries are (*a*) that the local species of Anopheles carry malaria; (*b*) that these species breed in a few stagnant puddles. Many reasons combine to prove that the malarial fever in the colony is caused by the mosquito alone—probably entirely by the Anopheles species. Accordingly the disease might be prevented by a small outlay.—*Nature*, September 28th.

At a meeting of the Fishery Congress held at Bayonne on July 25th, a paper by M. Bellet, President of the Chamber of Commerce of Fécamp, was read, in which it was stated that Basque fishermen visited the coasts of **Newfoundland** five centuries before the discovery of America by Columbus, and named Cape Breton after the port not far from Bayonne. An historical account was given of the settlements established for the purpose of catching whales and codfish.—*Deutsche Rundschau*, Jahrg. xxii. Heft 1.

Among the observations taken by the Marchand expedition during its march through Abyssinia is one of the position of Menelik's capital, **Addis Ababa**. Captain Germain chose King Menelik's palace as the most stationary point in the town, and determined its co-ordinates to be 9° 1′ 4″ N. lat. and 38° 43′ 5″ E. The best map, compiled by the Italian, Captain de Chaurand (1894), places the palace nearly $2\frac{1}{2}$ miles more to the south and about 15 miles more to the east.—*Comptes Rendus* of the Paris Geogr. Soc., No. 6.

Japan has opened twenty-two new ports to foreign commerce. Of these, ten are on the main island, Hondo, namely, Shimidsu, Taketoyo, Yokka-ichi and Simonoseki on the south-east coast; Hamada, Miyadsu, Tsuruga, Sakai, Nanao, and Fushiki on the north-west coast. There are five in Kiusiu—Moji, Misumi, Kuchinotsu, Karatsu and Hakata. Three ports are opened in Hokkaido (Yezo) —Sinmororan, Otaru, and Kushiro. In Tsu-shima island, between Japan and Korea, are Itsuhara, Shikami (?) and Sasuna (?). Naha or Nafa in Okinawa, the largest of the Liu-kiu islands, completes the number.—*Illustrated Mail*, Nov. 29th.

Owing to the death of Mr. Muller and the compulsory return home of Mr. Weller on account of illness, **Major Gibbons**, who relied on these gentlemen to take steamers with supplies up the Mafukwe river, will have to abandon his plan of proceeding to the Luapula and by the Nile to Egypt. Major Gibbons has explored the Okavango from 18° 55′ S. lat. to the Kwito and the latter river to a point in lat. 15° 6′ S. and long. 19° E. Captain Quicke has ascended the Zambezi to Lialui, travelled thence to the confluence of the Kubangi and Kwando, followed the latter to its source, and thence reached the Lungobungo to the north, by which he returned to the Zambezi. Captain Stevenson-Hamilton has explored the lower course of the Kwando. The three travellers have between them covered 3500 miles.—*The Times*, October 19th.

At the instance of the Vienna Academy of Sciences, Colonel V. Sterneck has made certain investigations which have led to the result that a connection exists between **gravity** and the **temperature** of the Earth below the surface. He finds that for a rise in temperature of 1° C. there is an increase of gravity amounting to 4·3 times the fifth decimal of g. The eight experiments are, however, too few to justify definite conclusions. They consisted in determining the differences of gravity between the surface and the bottoms of four shafts 1365, 3609, 984, and 892 feet deep respectively, and there was great difficulty in ascertaining with accuracy such small quantities and in eliminating local disturbances of temperature. The mean density of the Earth was found to agree with the average of the latest calculated values, namely, 5·52.—*Geogr Zeitschrift*, No. 10.

Mrs. Bullock Workman, F.R.S.G.S., whose narrative of an ascent of the Biafo glacier and Hispar pass was published in the last number, writes to say that she has accomplished a much higher ascent. "With the guide Zurbriggen, we ascended the **Koser Gunge** in the Shigar valley, 21,000 feet high. Two camps were made, one at 14,700 feet, and the other at 17,900. Above 18,000 feet the ascent was

very difficult—over rocky arêtes to 19,000 feet, and then over steep snow slopes, with much freshly fallen snow. We were caught in a snowstorm with a high wind at about 20,000 feet, and were obliged to release our luggage-porter from the rope. He suffered from cold and wind—18 degrees of frost—rather than from the rarefied air. We were thirteen hours in reaching the summit from our highest camp and returning, being delayed fully three hours by wind, storm, and deep snow. Zurbriggen says it is an ascent *de premier ordre* even in India, and it gives me the record by 4000 to 5000 feet for women climbers."

Koser Gunge stands in the angle formed by the Shigar river and the Braldoh river.

Mr. William Bonny, the last survivor of the rear-guard of the Emin Pasha Relief Expedition, died in London last September at the age of fifty-two. For twelve years he served in the Army Hospital Corps, going through the Zulu and Sekukuni campaigns, accompanying the 94th Regiment to the Transvaal in 1880 and 1881, and being present at Tel-el-Kebir and other battles in Egypt. Joining the Stanley expedition, he had the misfortune to be left in the camp at Yambuya, and was the only European officer of the rear-guard who traversed the continent. Dr. Parke, in his *Experiences in Equatorial Africa*, p. 341, said of Mr. Bonny—"He is the only European remaining from the wreck; and, certainly, he must have been placed in difficult positions, which he seems to have got out of with credit."

Mr. Bonny was one of the officers who accompanied his leader to Edinburgh when Mr. Stanley lectured to the Society, and he then received the Diploma of Honorary Fellowship.

NEW BOOKS.

Russia on the Pacific and the Siberian Railway. By VLADIMIR. With Maps and Illustrations. London: Sampson Low, Marston, and Company, 1899. Pp. vii + 373. *Price* 14*s*.

This volume is almost entirely an historical compilation. An introductory chapter, based on Soloviev's standard work, gives in outline the course of Russian history up to 1582, about which year commenced the conquest of Siberia. The modern Moscow lies on the extreme eastern frontier of the old Slav dominion; consequently this initial period is conceived as the period of expansion to the Urals. This was, however, only the beginning of the great Russian march towards the Pacific. In 1636 Cossacks had already reached the Sea of Okhotsk, and the second chapter contains a detailed account of the conquest of Siberia, as begun in the west under Yermak and continued into the eighteenth century under Atlaroff in far Kamchatka. The Tchuktchi, however, still preserve a nominal independence in the north-east corner of Asia.

The struggle for the Amur is related at length, with descriptions of the varying fortunes of the intrepid Cossack pioneers, *e.g.* Khabaroff and Poyarkoff, in their unequal encounters with Chinese hordes. These lasted till 1689, when, by the treaty of Nertchinsk, Russia for the time being relinquished all claims to the Amur. This famous treaty is the first and most favourable that China ever concluded with a Western Power. "Nertchinsk and Shimonoseki are the extreme terms of the series marking the gradual decline of the (Chinese) Empire in the last two centuries." The Amur region is Russia's compensation for the Crimean

war. Its annexation, so peacefully accomplished, was the outcome of the genius of Count Muravieff-Amursky, but no one of his three expeditions down the great waterway would have had so felicitous an issue had not the Chinese suspicions been allayed by confidential communications that the troops were being despatched to resist expected invasions by the English and French. Needless to remark the small army never returned, and, when it was too late to do anything else, the Chinese signed the terms of the Convention of Aigun (1858), by which the Amur and Ussuri became the frontier line of the two empires. It was at the commencement of Muravieff's tenure of office as Governor-General of Eastern Siberia that Nevelskoy, one of his ablest coadjutors, determined the insular character of Sakhalin. A chapter is devoted to the Trans-Siberian railway, which, if it contains no fresh facts, at least gives a very clear impression of the far-reaching political and economical value of that gigantic enterprise. The concluding pages contain observations on Russia's relations with Japan and England. In regard to the latter, the view is expressed that "the hostility between the two races is mainly founded on errors and misconceptions," that there is no adequate motive for it, that their forces being "incommensurate," any struggle between them would be—to use Bismarck's expression—a struggle between the whale and the elephant; and that, on the contrary, England "should welcome the progress of Russia and encourage her in the task of developing regions hitherto neglected, and which perhaps no other nation would have been able to colonise." In this "Vladimir" will find all those who have studied the question in cordial agreement with him.

En Indo-Chine, 1894-95. Par le Comte Barthélemy. Paris: Librairie Plon, 1899. Pp. 240. *Price* 4 *francs.*

From a note at the end of this book we learn that it is only the first instalment of an account of the travels of the young Count Barthélemy in French Indo-China, and that a second volume may be expected during the course of the present year. In this volume we have not exactly a diary but rather extracts from a journal commencing on the 16th January and ending about the middle of April 1894, in which the writer describes in a somewhat commonplace, gossipy fashion what he saw in Saigon, Cambodya, Lower Laos, and Bangkok. The party of young Frenchmen did not pretend to make any attempt at original research or exploration. They seem to have been bent on amusement, and apparently in a country abounding with wild beasts and big game their shooting was limited to a few peacocks, with which they supplemented a necessarily meagre commissariat. We may add that the Count describes amusingly how he shot a dead crocodile and missed shooting a tame elephant. Of course no one travels in French Indo-China without coming on some things which are new to the average reader. At Saigon Count Barthélemy had breakfast with a local Lucullus, and he describes for the information of the gastronomic public a new sauce, which he declares is not disagreeable, viz., sauce nuoc-mam. It has the merit of being easily made. Take a quantity of fish, and leave them for two months to putrefy in a wooden box. When the mass has liquefied, and is full of white maggots, draw off the liquor, boil it, and keep it in earthen jars for future use. At the breakfast in question this sauce flavoured the fish and pork, after which came a still more appetising and recherché dish, viz., grilled palm worms. We have it on the authority of Count Barthélemy that "très analogue au goût de la salade de chou palmiste, le ver est beaucoup plus fin et nous n'hésitâmes pas à déclarer que c'était là un manger fort agréable et digne de fins gourmets." The party were lucky in arriving at Attopeu just in time to witness the announcement

to the mandarins of Laos the definite acquisition of their territory by the Government of France, and to hear their submission to and acceptance of the new régime. They also made a cursory inspection of the gold mines of Wattacop.

Here and there in the book are a few not very original or wise remarks on the colonial system in vogue in French Indo-China and Siam. Whenever the French wish to make a road in Laos or undertake a work for which native labour is necessary the villagers, who detest labour in any shape, take their canoes and migrate to the other (*i.e.* the Siamese) side of the Mekong, and, according to the Count, their liberty to do this is a public misfortune, and should be abolished. In fact, he advocates the corvée, or forced labour, but he would prefer that both banks of the Mekong should belong to France. Of course the real cause of all trouble is "perfide Albion." "Le Laos est donc impossible à gouverner tant que le Mékong formera la limite de nos possessions. Cette frontière sera sans cesse la cause de revendications, de conflits incessants. Comment déterminer si une famille est Siamoise ou Française? Elle a habité deux ans une des rives, de là difficultés sans cesse renaissantes où l'insolence des Siamois, depuis quelques années, ne connaît plus de bornes. Que de fois ai-je entendu de bons patriotes me raconter, les larmes aux yeux, qu'on avait, de l'autre rive, insulté leur pavillon lorsqu'ils approchaient avec leur pirogue, pêchant ou surveillant le fleuve. Mais il semble qu'une puissance occulte protège les Siamois contre notre juste colère, et cette puissance nous la connaissons tous, nous autres qui avons été aux colonies, aussi me dispenserai-je de la nommer." The Count is young, and so we may hope that with his years his experience and good sense will increase, in which case his present opinions will be considerably modified, and become much more valuable.

Le Tour d'Asie: Cochin-Chine, Annam, Tonkin. Par MARCEL MONNIER. Paris: Librairie Plon, 1899. Pp. 331. *Price* 5 *francs.*

The "Librairie Plon" has done well to publish in book shape the vivid and graphic letters written by Monsieur Marcel Monnier, describing his tour in Cochin-China, Annam, and Tonkin during the years 1895, 1896, and 1897. The tour was continued into China and Japan, but we are not told if the writer means to publish his impressions of these countries also. What with the Dreyfus affair and the imbroglio with the Transvaal, we have forgotten, more or less, that there ever was a question of the partition of China, and the Chinese-Japanese war is now ancient history. Monsieur Monnier tells one story regarding the latter, which shows that the French in Indo-China have one true prophet, or, at least, a far-seeing man among their functionaries there. "On demandait récemment à l'un des hommes les mieux placés pour connaître les choses du Céleste Empire quel effet produiraient, suivant lui, dans les habitudes et les idées de cette population de quatre cent millions d'êtres, chez les classes élevées aussi bien que parmi les couches profondes de la nation, les leçons de la guerre Sino-Japonaise, les rudes enseignements de la défaite. 'La Chine,' repliqua-t-il, 'était ainsi.' (Et, ce disant, la tête appuyée sur sa main droite, il prenait l'attitude d'un homme assoupi.) Elle dormait; ce coup de tonnerre l'a tirée de sa léthargie. Ce qu'elle va faire? Changer de position et se rendormir du côté gauche."

This volume is very interesting, and is one of the best accounts of French Indo-China that has yet appeared. The author steers clear of politics and seldom puts forward theories of his own, and his book is exceptional as containing not a word against Great Britain. Monsieur Monnier has travelled much, and has

used his sharp powers of observation well, and is quick to note points of resemblance in such different localities as the valley of the Nile and Annam. The volume is embellished by a number of good illustrations, and is furnished with a useful map.

Vers le Nil Français avec la Mission Marchand. Par CH. CASTELLANI. 150 illustrations d'après les photographies et les dessins de l'explorateur. Paris: Ernest Flammarion, N.D. Pp. 437.

M. Castellani is fain to be amusing, but the laugh is not seldom at him where he is fain to have it with him. He is an artist by profession—he signs himself "Peintre"—and it must be with an artistic feeling of fitness that he begins by telling all the world that he belongs to Courbevoie, for thoughts of Paris often occur, and it is no slight part of the amusement to keep these associations in view while one follows him on his way to "le Nil Français." May we add that in our perusal of his work Castellani of Courbevoie has recalled to us Tartarin of Tarascon?

However well pleased he may be with Courbevoie, M. Castellani tells us that the vagabond mood seizes him occasionally, and he must needs go he knows not where. On this occasion it was a proposal that was made to him by the Director of *Illustration*, to whom he had spoken about a visit to Africa, say the Transvaal. Having readily accepted this commission, he was forthwith put *en rapport* with a mission to the Haut-Oubangui, at the head of which was Captain Marchand. He quitted Paris on the 10th of May 1896, and embarked on the 25th at Marseilles for the Congo.

M. Castellani divides his narrative into three parts—from Marseille to Brazzaville, from Brazzaville to Bangui, and from Bangui to Anvers. From this it will be seen that M. Castellani had not got very far on his way to the Nile when he quitted Bangui on the 22nd of March 1897 and set his face towards Courbevoie. The fact is, certain incompatibilities between the artistic and the military temperaments, as represented by M. Castellani and Captain Marchand, made it hardly possible for them to get on well together. The latter desired or decided that the former was to mount the Ubangi along with himself, and on the same boat. This looked like surveillance. M. Castellani had been waiting at Brazzaville since the end of October, and such was his desire to proceed that, in the face of positive orders, he managed to stow himself away on board the *Faidherbe*. He was, of course, brought back when discovered, but this episode suffices to show his disregard for military discipline, against which he has several tirades. He got on well, however, with the others, especially with Captain Baratier. Ill-health and the suppression of an insurrection on the route between Loango and Brazzaville had delayed Captain Marchand, and it was not till the 24th of January that M. Castellani finally set out from Brazzaville for the Upper Ubangi.

M. Castellani possesses a shrewd wit and wields a racy pen. British readers will make some allowance for his passing gibes, which are too silly to offend. At Konakry he notes that this port is bound to become one of the most important commercial places on the coast, and although it is not at all in his line, he is delighted to learn that the caravans will bring their rich products from the Haut-Niger and the Fouta-Djalon, and divert the trade from the English colony of Sierra-Leone. The best part of M. Castellani's book, from a geographical point of view, is the account of the country between Loango and Brazzaville. It is, for the most part, a book of impressions, but incidents, episodes, and comments give a good idea of life on the Congo. His aim was to see, to touch "la barbarie

et la primitivité," and that desire must have been gratified to the full. But the end of it all is to denounce colonial expansion, and his last words are—printed in capitals—"N'allez pas au Congo ! ! !"

The illustrations are excellent, more especially his pencil drawings of most of the officials whom he met, both French and Belgian.

The Key to South Africa: Delagoa Bay. By Montague George Jessett, F.R.G.S. London: T. Fisher Unwin. Pp. xvii + 178. *Price* 6*s.*

The importance of Delagoa Bay, with its port of Lourenço Marquez, is derived from two facts. Eastwards from Cape Town it is the first sheltered and capacious harbour met with on the South African coast; for Port Elizabeth and East London are, for large craft, roadsteads open to rough seas, and Durban with similar seas has a troublesome bar. Further, and chiefly, it is the nearest harbour accessible from the South African Republic—"the natural port of the Transvaal." From Pretoria Lourenço Marquez is distant by railway only 348 miles, all except 55 of which fall within the Republic's boundary. The drawback to it is that it belongs to Portugal, whose administration is feeble, and whose resources for developing it are practically nil.

The author describes with an abundance of superlatives the capabilities of Delagoa Bay. He remarks that he feels that Great Britain has a very strong right there. Great Britain's right, however, accrues only when Portugal decides to part with hers, and Portugal, with natural sensitiveness, has hitherto clung to this token of her vanished greatness. The sentiment is not likely to be weakened by the eager expression, such as our author's, of the desirability of her relinquishing it because she is not fit to hold it. Nevertheless, in due time, Delagoa Bay will doubtless come under British control, and its port attain the size and importance which its natural advantages bespeak for it.

The book has little literary merit or permanent value. But its appearance just now is opportune; and it fulfils its author's object, namely, to provide in a concise form some general information about the past, present, and possible future of Delagoa Bay.

Islam in Africa. Its Effects—Religious, Ethical, and Social—upon the People of the Country. By Anson P. Atterbury. With Introduction by F. F. Ellinwood. New York and London: G. P. Putnam's Sons, 1899. Pp. 197 and Index. *Price* 5*s.*

The Rev. A. P. Atterbury has done good service at the present time by publishing this very interesting volume. It is an exceedingly good account of a rather difficult subject, and we are glad to be able to agree in the main with the author's conclusions, namely, that the spread of Islam in Africa is not advantageous, and that those who think it will be a means for raising the heathen to Christianity are greatly mistaken. Commerce, as Livingstone long ago pointed out, and railways and telegraphs, will be the means whereby Africa will become Christianised, and Islam will form only a stumbling-block. As is pointed out in this book, Christians may in some ways adopt the methods of Islam, and certainly the Christian world should put forth strenuous efforts to reach the tribes where Islam has not already fixed its stamp of fanaticism and bigotry. The author truly states that Mohammedanism, in Central Africa at any rate, is not the same as it is in Turkey and Asia. He controverts the view of Dr. Blyden and Mr. Boswell Smith very successfully, and shows that where the trading Moslem missionary

(so-called) has penetrated, he has only given the people a veneer, a definite appreciation of one God, whilst at the same time his teaching has had little or no spiritual effect, and the most that the majority of so-called converts do is to repeat the formula of the Moslem creed and perchance a few prayers at stated times. On the other hand, slavery is kept up, so is polygamy, and women are not raised in the same way that is possible under the Christian religion. Mr. Atterbury opines that Mohammedanism is on the wane in Africa, and instances the defeat of the Dervishes in this connection. He calls attention, however, to the proposed Gordon Memorial University in the Sudan, and thinks that the idea "of utilising the Moslem power, with Khartum as a centre, for carrying on the work of civilising the millions of Equatorial Africa," which he thinks is included in the basal ideas of this university, is false. We are inclined to think so too, and making the difficult Arabic language the basis of the educational system is a waste of time and an error of judgment. He refers in a single sentence to the Moslem Society called Sid-es-Senoussi, which has a membership of probably 1,500,000 fierce fanatics, who aim at a "speedy, complete, and universal triumph of Islam." He might well have dealt with this subject in greater detail, for we believe that this Society has branches almost everywhere, and that it forms *the* great danger to the progress of Africa. Lord Kitchener might well keep his eye upon it.

All who are interested in Africa in its present development will do well to study this book with great care. If a second edition is called for, as it should be, it would be a great advantage were a sketch map added, showing clearly the native races in Africa to which the author refers, and also the distribution of the Mohammedan religion at the present time. The author has evidently a very great idea of the intellectual capacity of the natives, and in the main we agree with him, and we also agree with his statement that when a native professes the Moslem creed he is on an equality with all his co-religionists and may rise to the highest rank, as the great Prophet indicated to Bilal his slave and faithful follower. We are inclined to agree with Mr. Atterbury in his estimate of Mohammed, but into the purely religious discussion it is not necessary for us to enter in these pages.

The Naval Pioneers of Australia. By Louis Becke and Walter Jeffrey. London: John Murray, 1899. Pp. 313. *Price* 7*s.* 6*d.*

This work, we are warned in the preface, does not pretend to be a history of Australia. It is at best a contribution towards it, an attempt to show how four naval officers, viz., Captains Phillip, Hunter, King, and Bligh grappled with the grave difficulties of trying to work a new penal settlement on the lines of a colony, and what success they had in their task. To those who are acquainted with the early history of Australia this volume will have no attraction in the shape of fresh matter or information. But to those who have not read the story of Australia in the beginning of the century it may be commended as a pleasant and readable sketch, biographical rather than historical or scientific. The first chapters sketch the early voyages of the Portuguese, Spanish, and Dutch, and notice the careers of Dampier and Cook. With chapter iv. begins the story of "The Naval Pioneers of Australia" and the strange history of the colony as a penal settlement under their charge. Two chapters are assigned to the explorations of Bass and Flinders, and the unfortunate adventures of the brave Matthew Flinders are told with much enthusiasm and spirit, assisted by well chosen extracts from his interesting letters to Sir Joseph Banks. The illustrations are mostly taken from records in the early part of the century.

The Romance of Australian Exploring. By G. Frith Scott. London: Sampson Low, Marston, and Co., 1899. Pp. 328. *Price* 6*s.*

The author disclaims any intention of writing a book of scientific value or a work of reference. He describes the incidents and adventures of the journeys rather than the geographical results, and selects only some of the most noted explorations. From a geographical point of view the account is therefore incomplete, but it gives a general idea of the gradual opening up of the country, and the difficulties encountered by explorers, which may be acceptable to the general reader. The story stops short at the crossing of the continent by Stuart in 1862, the later journeys being described in the preface as "subsidiary." Seeing that the travels of Forrest, Giles, Carnegie, and others have revealed to us nearly a third of the continent, the epithet seems scarcely appropriate.

The maps are poor; all the routes might have been marked on one, or, still better, sectional maps on a larger scale might have been given with more detail, so that the country discovered by each explorer might have been more clearly defined.

The Part borne by the Dutch in the Discovery of Australia, 1606-1765. By J. E. Heeres, LL.D., Professor at the Dutch Colonial Institute, Delft. Published by the Royal Dutch Geographical Society in Commemoration of the 25th Anniversary of its Foundation. London: Luzac and Co., 1899. Pp. 106.

This handsome work is considerately printed both in English and Dutch, the author remarking that "the defective acquaintance with the Dutch language of those who have made the history of the discovery of Australia the object of serious study, or even, in the case of some of them, their total ignorance of it, certainly appears to me one—nay, even the most momentous—of the causes of the incomplete knowledge of the subject we are discussing." After the publication of the present work, writers on Australia will have no excuse for ignorance of the splendid achievements of the Dutch navigators between 1606 and 1765. The work is illustrated with several of the quaint maps and charts of the early Dutch explorers, an inspection of which will interest our Australasian fellow-countrymen.

Norwegen. Von Prof. Dr. Sophus Ruge. Bielefeld und Leipzig: Velhagen und Klasing, 1899. Pp. 140. *Price* 3 *M.*

The publishers are issuing a series of monographs entitled *Land und Leute*, of which this is the third. Professor Ruge, the well-known geographer, has given us a very interesting sketch of the country, with a large number of statistics on the population, its distribution, commerce, and occupations. The various parts of Norway and their beautiful scenery can only be briefly described. As the author quotes from L. Passarge—"Dem Reisenden in Norwegen geht es wie dem Besucher einer grossen Gemäldegallerie; er muss sich damit begnügen einzelne Bilder zu betrachten und hundert andere, kaum weniger wertvolle, zu übergehen." But he guides us through some of the most interesting districts, at the same time giving some details of the local customs, costumes, etc. Perhaps the life in the inland districts might well be more fully described, the summer sojourn on the sætter, the dreary isolation in winter, when the ground is covered with snow and the fiords in their inner parts are frozen over.

The vocabulary at the end of the book is too short, and not free from errors, and bibliography might be extended with advantage. On the whole, however, the work is carefully compiled, and presents a vivid picture of Norway and its inhabitants. The publishers have supplied a large number of excellent illustrations and a good map, and the printing, paper, and binding add to the attractions of the volume.

Cuba. Von Dr. E. Deckert. Bielefeld und Leipzig: Velhagen und Klasing, 1899. Pp. 116. *Price M.* 3.

The thoroughness of German literary workmanship is well evidenced by this little work, another of the "Land und Leute" series. The very map of Cuba appended differs from that to which we are accustomed, for it indicates the plantations of sugar, tobacco, and coffee, and gardens and fruit ranches, as also the portions of rivers navigable for ships, railways, main roads, telegraph cables, mangrove and forest marshes, and coral reefs, with the heights and depths in mètres. Add to this a good letterpress, and numerous and excellent illustrations, and we have a very complete book on Cuba.

Annals of Duddingston and Portobello. By William Baird, F.S.A. Scot. Edinburgh: A. Elliot, 1898. Pp. xviii + 509.

This volume is from the pen of Mr. William Baird, who is already so well known as an author of local histories. Originally it was intended as a record of the burgh of Portobello, now merged in the city of Edinburgh, but it was found that the book would not be complete unless the parish of Duddingston was included. The volume contains much local information which was previously widely scattered and practically inaccessible, but which is now presented in chronological order to the reader. Not the least interesting part of the work lies in the old maps of the district, several of which are comparatively rare. The sketch histories of local families contain much readable information, and will be especially interesting to those residing in the neighbourhood. An appendix contains many curious and interesting excerpts mostly culled from the charters of Kelso Abbey, to which Duddingston was attached. The volume is well printed and well illustrated, and Mr. Baird is to be congratulated on the success of his labours.

The International Geography. By Seventy Authors. With 488 Illustrations. Edited by Hugh Robert Mill, D.Sc. London: George Newnes, 1899. *Price* 15*s.*

Every advanced student and teacher of geography, every intelligent lay reader, will assuredly add *The International Geography* to his list of "Hundred Best Books." Under the able editorship of Dr. Hugh Robert Mill, and under the authorship of a long roll of the most distinguished geographers of the world, we have briefly summarised before us a thoroughly scientific description of each continent and country of the world, dealing in turn with its physical, biological, and political aspects. This is preceded by a general treatment of the principles of geography dealt with in a masterly though perhaps too brief a fashion. In cursorily looking through more than a thousand pages, each of which bristles with information and ideas, it is impossible to give a just judgment of the full value of the work. But, in spite of hunting through and through for inaccuracies, misstatements, or unsound treatment of the subject, we are bound to confess that we are more and more enamoured with the book, and fail to find anything of importance to criticise adversely even in the branches of the subject that we are most familiar with. The sketch-maps and diagrams are of special interest. They are clearly printed, and their uniformity of shading and lettering at once leads to fully understanding them. The editor, authors, and publishers must one and all be thoroughly congratulated on the success of this publication.

NEW MAPS.

EUROPE.

BATH AND BRISTOL. Reduced Ordnance Survey. Sheet 28. *Price* 2*s.*

GLASGOW, Pocket Plan of —— and Suburbs. New and enlarged edition. *Price* 1*s.*; *cloth,* 2*s.* *John Bartholomew and Co., Edinburgh.*

ASIA.

SWATOW, Map of the Neighbourhood of ——. In 14 Sections. Scale of Sections 1 to 12, one inch to a mile. Scale of Sections 13 and 14, half an inch to a mile. By Rev. W. Riddel, M.D., assisted in the Hok-lo parts by Rev. J. C. Gibson, D.D., Rev. W. Ashmore, and Dr. P. B. Cousland. 1899.
Presented by the Rev. W. Riddel.

This map embraces the country from Pheng-Hai (Hai-Feng) in the south-west to Yung-ting in the north, and also shows the course of the Han river to Ting-chau. Great care and caution seem to have been used in the compilation, all topographical details, as villages, roads, rivers, etc., being distinguished by different marks according as their positions or directions have been well determined or are doubtful. The names of district cities are given in Mandarin, with the local names underneath. Names of other places are given in the dialect of the people—Hok-lo or Hak-ka. Dr. Riddel has done a very creditable piece of work and set a good example which, it is to be hoped, other missionaries and residents in China will follow.

AFRICA.

SOUTH AFRICA, Special Map of ——. Scale 1 : 2,500,000, or 39·4 miles to an inch. *Price* 1*s.* *John Bartholomew and Co., Edinburgh.*

ORANGE FREE STATE, New Map of the ——, the southern part of the South African Republic, the northern frontier of Cape Colony, and Delagoa Bay, in Portuguese South Africa. Scale 1 : 1,000,000, or 16 English miles to an inch. *Price* 3*s.* *Edward Stanford, London.*

The former map is specially intended to illustrate the present war, and, including the whole of South Africa, has the advantage of showing the lines of communication between Cape Town and Durban and the frontier. The map of the Orange Free State supplements that of the Transvaal noticed on page 560, and the two together include the whole of the Boer States and the adjoining British territory where military operations are now in progress. For both maps the Survey map of Cape Colony has evidently been made use of.

ATLAS.

ATLAS OF METEOROLOGY. A series of over four hundred maps prepared by J. G. Bartholomew, F.R.S.E., and A. J. Herbertson, Ph.D., and edited by Alex. Buchan, LL.D., F.R.S. Bartholomew's Physical Atlas, Vol. iii.
A. Constable and Co., Westminster.

A notice of this important work will be published in the December number.

THE SCOTTISH

GEOGRAPHICAL

MAGAZINE.

JAMAICA, WITH REMARKS ON SOME OF THE OTHER WEST INDIAN ISLANDS.

By Alfred G. Nash, B.Sc., F.R.S.E., F.R.G.S., C.E.

(*With a Map.*)

No part of the New World is richer in interest for the student of geography and colonial history than the Caribbean archipelago, which, commencing abreast of the Straits of Florida with the disordered group of the Lucayas or Bahamas, and with Cape San Antonio on the west of Cuba, embraces the Greater Antilles and then sweeps from them in the beautiful crescent of the Lesser Antilles, known officially as the Leeward and Windward Islands, from Porto Rico almost to the mouth of the Orinoco.

The little low-lying island of San Salvador (Watling island) in the Bahamas holds the distinction of being the first land in the New World sighted by Christopher Columbus, and on its shores in the harbour of Riding Rocks may now be seen a modest shaft of coral rock, which marks the spot on which the great discoverer first set foot and kissed the soil of the Western hemisphere, and where that befitting ceremonial was enacted which dedicated to the united sovereignty of Castile and Aragon the first fruits of his enterprise—Spain's first spot of empire in the New World.

As the portals through which he passed to the revealing of the great continent beyond, and as the scene of the most interesting and dramatic incidents of his life, the West Indies are invested with a special claim on the regard of geographers, while as a great field of human action and adventure for over two centuries they are full of historical reminiscence.

In his despatches to Spain, and in his interviews with the Court, we find these islands occupying the most prominent place in his recitals of

particulars, and the subjects of his unfeigned wonder and admiration, as he dwells with almost poetic fancy on their natural beauty and resources, and the possibilities which attached to them in increasing the wealth, grandeur, and prestige of the Spanish crown, while in token of his fond attachment to these islands a representation of them, surrounded by azure waves, forms a portion of the armorial bearings granted to him by the court of Spain.

It was on the island of Hayti (Hispaniola), and under the direct auspices of Columbus, that San Domingo, the first city built by Europeans in the New World, was founded, while it was on the island of Cuba, the Pearl of the Antilles, that the standard of the cross was first unfurled. Both these islands in turn were proud to have the honour of guarding his remains, until reverses of fortune, which changed the destiny of the one and then the other, left them not a resting-place under the control of Spain in that world which he had unveiled and annexed for her glory.

It was in Jamaica that he took refuge from the first hurricane recorded in this region, and it was on this island that for twelve months he was left by the treachery of the Governor of Hispaniola, to undergo the sufferings both of body and mind which drew from him the pathetic letter which he addressed to the king and queen of Spain.

This period of detention in Jamaica presents us with perhaps the most remarkable incidents in the career of the discoverer; and in the remarks on the island which follow, a reference will be made to those events which may be considered the most important in connection with historical geography.

Associated with the West Indian islands are some of the most memorable exploits recorded in naval history, and a reference to the brilliant works of Captain Mahan shows how closely these islands are identified with some of the greatest achievements in naval warfare, while that great Pantheon of the nation, St. Paul's Cathedral, possesses many proud tributes to British valour in these waters. Sir Francis Drake and Sir John Hawkins both died in these parts in 1595 and 1596 respectively. The names of Frobisher, Hood, Benbow, Parker, Blake, Nelson, Abercromby, and many others may be traced at some period or other of their careers amongst these islands; while the naval supremacy of Great Britain was established in these seas by the splendid victory of Lord Rodney over the French when they planned an invasion of the island of Jamaica in 1782.

As the most ancient of Great Britain's colonial possessions taken together, these islands under her rule hold a special lien on the solicitude of the mother-country, to whom throughout their chequered careers they have been true to the best traditions of loyalty; and the circumstances which have brought about a change in their fortunes, in most instances for the worse, appeal directly to her sympathy and consideration.

Physically the West Indian islands are of interest in their varied configuration of surface, in the charming diversity of scenery and climate for which they are noted, as an area over which earthquakes and

hurricanes occasionally display their irresistible power of destruction, and as the region from which emanates that mightiest of ocean currents, the Gulf Stream, while interesting theories of a submerged Antillean continent find expression in the scientific magazines of the day. We have the authority of Reclus that from 1493 to 1885 three hundred and sixty-five hurricanes were recorded as having occurred amongst these islands, to which number at least ten of serious consequence may be added up to the present year.

Financially, commercially, and socially the West Indian islands have passed through most changeful conditions, and what may be said in regard to Jamaica obtains to a great extent in respect of the other British colonies in the Caribbean Sea.

Like the other West Indian islands belonging to the group of the Greater Antilles, the greatest length of Jamaica lies east and west. It seems highly probable that the equatorial currents which sweep past their shores before entering the Gulf of Mexico, have exercised considerable influence in determining the shapes which these islands have assumed; the influence of the currents is demonstrated in the prolongation of the land in its western portions, and in the somewhat lower altitudes there compared with the eastern districts.

This group also lies within the area of gradual elevation, and in the Neotropic region biologically. The elevating forces, while not affording such marked proofs of geological change in Jamaica as in some of the neighbouring islands, are nevertheless undoubtedly in action here. The most marked evidence of alterations in the levels of the land in the Greater Antilles is to be found at the eastern extremity of Cuba, where at Cape Maysi raised benches form an interesting feature of the landscape. The most striking physical feature of the island of Jamaica is the bold range of the Blue Mountains, which attaining its highest elevation in the east, and with its main axis showing a general trend in a north-westerly direction, sends off spurs at varying angles towards the seaboard on the north and south.

As would be expected, such a range has a powerful effect in the distribution of rainfall, especially in a latitude where evaporation is excessive, and accordingly the north-easterly trade-winds, which arrive from the Atlantic saturated with moisture, find an efficient condenser in these mountains, which present all the conditions necessary to produce this result. The wet winds are thus forced to part with a good deal of the water with which they are charged on the windward slopes of the mountains, while a smaller portion falls on the leeward side in diminishing gradations, from the highest lands to the comparatively dry plains of Liguanea on the south. These rains and the periodic monsoon rains which occur twice annually in May and October, and are brought about by solar transit, are formidable factors in remodelling the surface of the land and in the redistribution of the soil. Although attended sometimes with disastrous effects on cultivation, and with danger to public and private works, there is no doubt that to these seasons is due a large amount of the fertility which this island enjoys, while as a moderating influence on climate in this latitude their effect is incalculable. The

time of their occurrence regulates the principal planting seasons, and the disintegration which takes place by their action on the mountains offers a recurring means of recuperation to the partially exhausted plains below. The uneven surface of the island points largely to fluvial action, and to this fact must be attributed the numerous separated valleys, which, fed by rivers, springs, and gullies, led to the name of Xaymaica—Isle of Springs—conferred by the native Indians on the island—a name which it has retained ever since, being one of the few aboriginal names still surviving in the West Indies. From the dissected character of the surface, the rivers, although numerous, attain only in a few cases navigable proportions, and even then, like the Black river, are only available for barges. While parts of the island abound in streams, others are extremely deficient in this respect, and the white limestone formation which predominates is, on account of the faults and fissures and sink-holes which are characteristic of it, one in which comparatively few streams are found. The geological map of the island which accompanies this paper shows the connection between surface streams and the formations indicated.

The strong currents and seas which break on the north-east shores of the island at certain times of the year have by undermining and eroding action attacked the foreshore, except where defied by swampy embouchures, and the depression towards their central axes of this and the neighbouring islands of Cuba and Hayti at these points of their coast-lines, seems to offer proofs of change of outline from this cause. A compensating influence is at work on the corresponding leeward shores, where the detritus from degraded hills has gradually settled, creating those large alluvial plains which are to be found on the southern districts of the island. The longest rivers are therefore on the south side of the island. Many of the rivers, at some point or points in their course, sink below the surface. In some cases, like the Black river and Rio Minho, this occurs several times before they assume continuity in their courses. The *régime* of the rivers is considerably affected by the quantity of the rainfall and the nature of the ground, and many of the streams and burns which in ordinary or dry weather appear thoroughly incapable of doing mischief, are converted by a few hours' heavy rain in their tributary valleys into veritable demons of destruction. The recurrence of the wet seasons, the trade-winds, and the land and sea breezes combined with the mountainous character of the island bestow upon it a climate far more genial than its intertropical position would lead one to expect, and gradations of temperature suitable to almost any constitution can be found, from sea-level up to Blue Mountain Peak, while the introduction of railways, hotels, and a fine system of main and parochial roads afford visitors and searchers after health the opportunities of finding the conditions most suitable to their requirements.

As a health resort during the cool and dry months, extending from November to March, the value of the island has been fully recognised by both European and American physicians, and several valuable mineral springs are available for the special treatment of rheumatic and other disorders. The popularity of Jamaica as a retreat from the cold winters

of the States and Canada is growing, and in England its merits in this respect are becoming better known each year.

The harbours of the island are numerous, while that of Kingston, from its bold stretch of water, capaciousness, leeward position, good anchorage, and splendid protection afforded it by the narrow coral peninsula of the Palisadoes, takes a high rank amongst the first harbours of the world. At the extremity of the reef lies the chief naval station of Port Royal, and what remains of the historic town of the same name, which was engulfed by the earthquake and sea rollers of 1692. This city was the rendezvous of the famous buccaneers under Sir Henry Morgan, their admiral, and the emporium for their booty, and was then considered, for its size, the richest city in the world.

The construction of either the Panama or Nicaragua Canal would confer on Jamaica an advantage which it would be difficult to estimate. Lying as it would in the very track of a great maritime traffic through this proposed "New Gateway of the World," and enjoying every geographical advantage, the island would assume new importance as a docking, coaling, and victualling station in the great development of trade which would attend the linking together of the two greatest oceans of the world—the Atlantic and Pacific; while as a point of strategic command it would probably acquire considerably increased importance to the empire.

Lying between the parallels of 17° and 19° N. lat. and 75° and 79° W. long., and on the mean isobar of 30 in. and isotherm of 80°, Jamaica comprises rather over 4207 square miles. It was discovered on 3rd May 1494 during the second voyage of Columbus, when he was cruising off the southern shores of Cuba. Interpreting the statements of the native Indians who escorted him with a flotilla of canoes to signify that the land from which they obtained their gold lay to the south, he directed his course to that point, and aided no doubt by those conditions of the atmosphere which are the precursors of the regular seasons and enable one to discern objects from a considerable distance, he soon came in sight of the magnificent range of the Blue Mountains. The time of the year at which Columbus discovered and the direction from which he approached it were peculiarly felicitous for the best impressions, which were probably further influenced by the reported wealth which the island was said by native accounts to possess. As he entered the beautiful bay on the north side of the island his admiration found expression in the bestowal of the name of Santa Gloria (now St. Anne's Bay), which he gave to this port, and in his despatches to Spain he reports the island as the most beautiful he had yet discovered. It was, however, during his fourth and last voyage, and under circumstances of profound anxiety and suffering, that he made a more intimate acquaintance with the island and its natives.

Arriving again in Jamaica almost by miracle on the 23rd of June 1503, he was not rescued until the 28th June 1504. It was during this period of cruel detention, privation, and suffering that the most dramatic and affecting incidents of his life occurred. We find him also despatching, by the faithful Diego Mendez, one of the most famous

documents which has been brought to light in connection with his discoveries, that on which is sketched the coast-line of Veragua, which he was exploring when driven by a cyclone to seek refuge in Jamaica.

Thus his last active service to geography was a search for that maritime highway which Nature has denied, but which "the ingenuity and enterprise of man intend to supply."

Diego Mendez, accompanied by one Spaniard and six Indians, embarked in an Indian canoe with instructions to proceed to San Domingo, there to report the perilous and suffering condition of his chief, and to request relief from the Governor, Ovando, then to continue his journey to Spain with the special despatches which were intrusted to him. After three days of peril and privation the small party, in their improvised craft, arrived at the little barren island of Navasa, off the eastern coast of Hayti (Hispaniola). Here some of the Indians died from exposure and thirst. Pursuing his mission with heroic fortitude and with loyalty to the admiral, Mendez passed over to Cape Tiburon, and thence coasting eastward to Xaragua he reported the condition of Columbus, and proceeded to San Domingo, where he was provided with the means of reaching Spain on his official errand. King Ferdinand, in recognition of this service and his loyalty, granted to Mendez the use of armorial bearings in which were depicted, in memory of his courage and devotion, the device of an Indian canoe. An inscription on his tomb relates his faithful services, while the carving of an Indian canoe also adorns it. It was thus, and running the gauntlet of considerable dangers, that the most valuable document extant relating to the discoveries of Columbus was conveyed to Spain—viz., the Sketch Map of the Atlantic Seaboard of Central America from the Gulf of Honduras to the Isthmus of Panama. This map, which is referred to by Dr. Carl Peucker as being brought to light by Dr. von Wieser of the University of Innsbruck from the *Bibliotheca Strozziana* (see *Geographical Journal*, vol. iii. 1894) is, as Dr. Peucker states, "the only special map preserved to us relating to the fourth voyage of Columbus, and absolutely the only map which dates back to the great discoverer himself." The date of the letter, the 7th July 1503, coincides with the period at which Mendez undertook his perilous errand, and thus was borne from the island of Jamaica to Europe the "precious historical relic" referred to by Dr. Peucker.

The attachment of the family of Columbus to this island is also illustrated in the choice made by his grandson Louis, who, in accepting a modification of the agreement originally made between the Spanish Government and the admiral, exchanged the title of Viceroy and its attendant emoluments for the island of Jamaica, together with the titles of Marquis of Jamaica and Duke of Veragua. Coming to the present sovereignty of the island, we find it the first inhabited Spanish colony which capitulated to British arms in these seas—this occurred in 1655, the Spanish sovereignty extending from 1494 to 1655. It was due to Oliver Cromwell, who, ambitious to found a British colonial empire in the West, and also, no doubt, from a desire to distract the attention of troublesome political factions at home by opportunities of adventure abroad, that the expedition commanded by Penn and Venables was

KINGSTON HARBOUR.

THE HARBOUR AND TOWN OF MONTEGO BAY.

PORT ANTONIO.

NEWCASTLE, THE MILITARY SETTLEMENT, 3800 FEET ABOVE SEA-LEVEL.

despatched, with the island of Hayti (Hispaniola) as the objective point of attack. Failing in this purpose they turned their thoughts to Jamaica, which in its feebly protected state fell an easy prey to the enterprise.

It is, however, apparent from the following extract from the State papers that the idea of conquest in the West Indies did not originate in the mind of the Protector, but found ready acceptance by him as a policy suiting his aspirations after colonial power. As early as 1630 proposals were made to King Charles I. for the establishment "of a plantation upon an island convenient to receive a fleet that has any design on any leeward part of the Indies as Carthagena, Portobello, Bay of Honduras, Hispaniola (Hayti), Cuba, or Jamaica." This ambitious scheme of conquest was, however, left for Cromwell to put into execution.

The flow and ebb of fortune which the island has experienced during the past 244 years have made its history, if not always a happy and agreeable one, certainly one possessing deep interest for readers of colonial records.

From occupying in her earlier days the foremost position as a dependency of Great Britain, and attaining meridian prosperity at the beginning of this century, we find her become at the close of it, amidst the splendid and vast possessions acquired since, only a tertiary star in that galaxy of Greater Britain which outshines the grandest period of the Roman empire.

The causes which contributed to the first decline in this and the sister British islands seem clear, the remedy clearer, but apparently not so easy of application. With bitter reverses of fortune these islands have still faith in the great agricultural resources with which Nature has endowed them, and which constitutes their potential wealth, and with similar productions of other countries not protected or encouraged by unnatural subsidies, they are quite capable of competing, and of doing so successfully, in the markets of the world.

As regards the markets of the mother-country the chief difficulty, and one fraught with immense results to these colonies, is the unfair competition which the sugar manufactured in these islands has to meet from the reception on the same terms of bounty-fed sugars of the Continent. In the United States, where a discriminative tariff has recently been adopted in favour of unsubsidised sugar, the British West Indian estates have been able to compete successfully, but it is not reasonable to expect that when the colonies which the Republic has acquired in the Greater Antilles, and when the productions of the Southern States are equal to the requirements of the union, its Government will not put into practice those principles of protection which have been her policy when similar conditions have arisen calling for self-preservation.

The manufacture of sugar, the staple industry of these islands, and one involving the weal of all classes, is threatened, by sheer pressure of unfair competition, with extinction.

Jamaica, with her varied climate and soil, can be utilised to a great extent for the cultivation of fruit and minor products, but it is not difficult to prophesy what the consequences will be to such an island as

Barbados where prosperity almost entirely depends on this industry. In Jamaica the exports of sugar in 1805 amounted to 150,000 hhds., while the statistics for 1897 place the export of the same commodity at 1600 tons, a smaller quantity than is sent from the much smaller island of Guadaloupe, belonging to France. While early in the century an almost unbroken continuity of estates extended for 220 miles along the seaboard of the island from the Yallahs river and along the north coast to Negril Point, and large areas were under cultivation in other parts of the colony, the surviving remnant is now represented by less than 150 estates carrying on in many instances their manufactures in a desultory manner or against the greatest odds. Absentee proprietors, the want of improved machinery and methods of manufacture, and the absence of central factories, have no doubt been accountable for a good deal, and consideration would have to be paid to these matters in any regeneration of the industry, but its full accomplishment can only be attained by measures which will either counteract or abolish a system which appears to be a direct violation of the true principles of free trade.

In the French islands of Martinique and Guadaloupe the most modern and scientific methods are in practice. Central factories have been adopted, twenty-one being in operation in Martinique alone, while the labour conditions are similar to those of the British islands; but the French Government was forced to recognise the fact that their colonies would still be handicapped unless the premiums given in France were extended to them. The report of the British Consul at Bordeaux for 1897 explains the character of these grants. He says, "It will be noticed that Great Britain took 9213 cwt. more sugar (altogether 631 tons from Bordeaux alone) than in the previous year. This sugar was almost entirely the product of French West Indian colonies, and was put on the English market with the following advantages over the sugar brought from the neighbouring British West Indian islands:—a bonus of 3 francs 50 centimes to 4 francs 50 centimes (2s. 10d. to 3s. 7d.) per 2 cwts., in addition to a distance *détaxé* or premium of 2 francs 25 centimes (1s. 10d.) per 2 cwts., or an advantage over British colonial sugar of about 2s. 4d. to 2s. 9d. per cwt."

That too much dependence may be placed in any one industry, however profitable at the time, may be justly adduced as one cause of the decay of these islands, and there is no doubt that almost fatal reliance was placed on the sugar industry as the *summa vita* of these colonies; but the nature and history of its development have to be taken into account in any consideration of the subject, before a just estimate can be formed. The manufacture of sugar had assumed its prominence just as the iron, woollen, or cotton industries in Great Britain have attained theirs—that is, the natural conditions, and also considerations of capital, labour, etc., were found suitable for such employment, and the character of the manufactures and the financial results justified enormous outlay in machinery and works, which could only be utilised for one specific purpose. Millions were spent in the equipment and maintenance of estates with machinery almost entirely imported from the large engineering works of Scotland. The refiners on the Clyde had the further advan-

tage of dealing with the raw article, which also formed valuable freight for British vessels. Sugar had established itself as an essential commodity of life, and markets had already been opened, with all indications of a rapidly increasing consumption, in all parts of the world: it was not easily perishable, and was capable of long transport without deterioration. Produce of another class would have to make its way into the habits and tastes of other countries, and neither the accommodation nor means of transport which are now available were present to deal with delicate articles like fruit with success. It was therefore not unnatural that proprietors, who had placed their capital and confidence in what they considered the soundest investments going, should hesitate to relinquish the struggle, which they knew by the natural order of things was entirely in their favour, if the subsidy which European rivalry had introduced were removed. The results of the contest are known, and while the revival of the sugar industry in some of the islands will partake more of the character of a resurrection, it is safe to say that, once given a re-start on equal terms, with the experience which they have gained in the school of adversity, and with good management and those improvements which science now offers, they are capable of rising once more into prosperous dependencies of Great Britain. If the imposition of countervailing duties is thought contrary to the principles of free trade in Great Britain, it seems that one remedy may be found by the institution of local bounties, regulated on the basis of the premiums given in the French islands, on the sugar exported to Great Britain and to those countries where no discriminating tariff is levied. The institution of such bounties, however regrettable as a measure of defence, would at once place the islands on an equitable footing, while by fighting the beet sugar manufacturers with their own weapons it might precipitate in Europe the abolition of a system which it is the earnest desire of British statesmen to remove. At the same time the introduction of such an innovation would keep a languishing industry alive, give new hopes to the islands, and encouragement to capital and enterprise. The comparatively small quantity of sugar on which a bounty would have to be paid for some years would not unduly tax the revenues of the islands, and would be returned tenfold in a few years by increased cultivation, output, and the spending capacity of the inhabitants, while a termination to the bounty system generally might be thus achieved. At any rate a trial, if only for a few years, of such a system might effect some permanent good.

That Jamaica has been able to ride out the tide of depression which has visited these islands for some years past has been due chiefly to the fruit trade, which from a modest beginning has developed within the last twenty years into one of surprising magnitude. Bananas and oranges find their natural habitat in the island, which now supplies an enormous quantity, especially of bananas, to the United States, where they have become almost an article of diet. The cultivation of other economic plants has been largely encouraged by the Government. The variety of soils and elevations from sea-level to 7360 feet, the culminating point of the Blue Mountains, gives gradations of temperature and a choice of conditions for fruit cultivation which is rather unusual within such

circumscribed limits of latitude. Besides the fruits already named, the cultivation of coffee, cocoa, kola, cocoanuts, pimento, ginger, and a large number of other economic plants receives attention, frequently in conjunction with fruit cultivation; this being the only island which exports pimento or allspice, so well known, while the ginger and Blue Mountain coffee maintain their reputation for quality and aroma.

As a field for emigration opinions are divided; all depends upon the character and circumstances of the would-be colonist. For the prodigal adventurer, or for the ordinary labourer or artisan without means, Jamaica would be a disappointing field; but men with health and energy and a little capital to make a start with would no doubt meet with success. The class of colonists who would have the best chances are those who can afford to wait for a while, gaining experience and insight during that period on well-managed fruit or other cultivations before applying their own means to investment. The fruit-trade seems to offer the best prospects for such investments, and its growing importance and the scope which the United States, Canada, and Great Britain offer for disposal of tropical fruit of the quality which Jamaica can produce are almost unlimited.

The Boston Fruit Company, who are the possessors of the largest fruit cultivations in the world, are the chief exporters to the States, and the quantity of bananas sent from the island reached a total of nearly seven million bunches in 1897, valued at £445,866.

The Jamaica orange compares favourably with the best of Florida or Californian growth, while the banana, which is larger than those shipped from the Canary islands, is also considered by many superior in flavour. At present little of these fruits finds its way to Great Britain, while what reaches Canada does so chiefly through the United States. A service of quick steamers, built for the fruit-trade between Jamaica and Great Britain, would undoubtedly confer great benefits on, and encouragement to, the trade of the colony. In regard to Canada, a similar arrangement would be attended with reciprocal advantage. The trade ties between the West Indies, which have been of the slenderest kind, would be strengthened. The Great Dominion, which is anxious to encourage commercial relations with the West Indies, would be able to supply the West Indies with much of what they now receive from the States, while Canada in return would receive the produce of sister colonies in the Tropics, and be able to distribute it by means of the great Canadian Pacific railway and its tributary lines over the Dominion from its terminal station at St. John, New Brunswick, on the Atlantic, to the uttermost limits of its ramifications.

The island is indebted to other countries for a large number of valuable economic plants, which have found the soil and climate well adapted to their successful cultivation. The produce of several of these exotics now forms the principal articles of export from the island.

On the white limestone formation the coffee and orange have found congenial conditions, while the sugar-cane and cocoa flourish on the alluvial and trappean soil, where the rainfall is moderate and regular, or where irrigation is available. Cocoanuts come to perfection near the seashore, especially on the north side of the island.

Pimento, which is indigenous to the island, grows best on the white limestone soil on hilly situations pervaded by sea breezes.

The plants of Jamaica offer a wide field for study and practical use, and the medicinal and curative qualities of many have been long known. The botanical works of Suartz, Sloane, Bartram, Brown, Lunan, Dancer, M'Fadyen, and others are authoritative, and important additions have been made to our knowledge of improved methods of culture in more recent years by the contributions of Dr. Morris, the Imperial Commissioner on Agriculture for the West Indian islands, the Botanical Department, and the Agricultural Society of the island. That great national repository of natural history, art, and literature, the British Museum, owes its origin to the splendid biological and ethnographical collection brought from the island by Dr. Sloane in 1689 (afterwards Sir Hans Sloane), who bequeathed them to the nation in 1753.

The fauna of the island is dealt with in the classic and entertaining works of Gosse and Hill. The introduction of foreign animals and reptiles has not been as often attended with success as that of plants, and many of the insect and other pests of the island are due to the incautious and ill-considered action of persons who had exaggerated ideas of their utility. The Indian mongoose, brought ostensibly for the purpose of exterminating the canepiece rat, has turned its chief attention to the raiding of poultry yards, the destruction of ground birds and harmless lizards and snakes, and has established itself as a general nuisance. The family of Ixodes or ticks is also well represented, having been introduced into the island on cattle imported from Colombia and other parts of the mainland, and has proved one of the greatest insect pests of the colony. The most troublesome and vexatious are the tiny ones, which, collecting on the blades of grass or on shrubs, await the arrival of the first animal, man or beast, on which they dislodge themselves in bulk as soon as they are touched. The late Mr. Bates, F.R.S., who studied their habits in Brazil, says "that they hold on by their fore-legs only, the other three pairs being stretched out so as to fasten on any animal which comes in their way." Beyond these drawbacks to outdoor life at certain seasons of the year, the island is remarkably free from insects or reptiles of a venomous nature, and one soon gets accustomed to take interest in the concert of insect voices which at nightfall makes itself heard in this latitude.

The first official map of Jamaica under British rule was completed in 1676; since then several compilations have been made, with marked improvement on the original, but no trigonometrical survey of the island has ever been executed, and it is to be hoped that in these days of geographical accuracy, and for official purposes also, such an important work will not be long delayed.

A SKETCH OF THE GEOLOGY OF JAMAICA.[1]

After R. T. Hill of the U.S. Geological Survey.

The relief of Jamaica is distinctly mountainous, and at the first distant view from the east the island presents a group of mountain summits rising above the sea in a tangled mass, without systematic ridges or secondary types of relief. But on a nearer approach four distinct predominant types are easily recognisable, besides numerous secondary modifications. The chief features are (1) the interior mountain ranges constituting the nucleus of the island; (2) an elevated limestone plateau, which surrounds the interior mountains and ends abruptly towards the sea; (3) the coastal bluffs or back coast border of the seaward margin of the plateau; and (4) a series of low, flat coastal plains around the periphery of the island, between the sea and the back coast border. The relation of the plateau region to the interior mountains is that of an elongated bench completely surrounding a higher sierra, the plateau having an outline somewhat like a child's bib, the mountains of the east protruding through the neck, while the main expanse, stretching westwards, presents occasional views of the buried mountain structure through rents and holes made by water. The interior mountains are marked by deeply etched salients and re-entering angles, whereas the hills of the limestone plateau present uncorrugated, densely wooded slopes.

The mountains of the interior comprise the Blue Mountain ridge, which dominates the topography of the eastern third of the island, and certain isolated summits to the west of the Blue Mountains proper, such as Jerusalem mountain in Westmoreland, and the Clarendon mountains. The isolated groups occur as limited inliers, surrounded and overlooked by hills of the limestone plateau. The Blue Mountains extend in a sinuous axis with many branches along a third of the length of the island, from near the eastern point, and trend to the north of west, parallel to the truncated north-east coast. The serrated crest culminates near the centre of the ridge in Blue Mountain Peak, 7360 feet high. West of this peak the elevation decreases till, at last, it sinks below that of the limestone hills beneath which the mountain structure was buried in ancient times. Westward of St. Catherine Peak (5036 feet), almost due north-east of Kingston, the main range bifurcates. The southern and larger branch continues in a sinuous course towards the north-west through St. Andrew, where it is known as the Ram's Horn ridge and Above Rocks, and on between St. Andrew and St. Mary as Goddard ridge to the drainage divide of the Rio Doro and Trumbell's river, near the line of the Port Antonio railway. Several other ridges radiate out from Catherine Peak to the north-west. All the western branches of the Blue Mountains terminate on the eastern side of the great basin of St. Thomas-in-the-Vale.

[1] Extracted from "The Geology and Physical Geography of Jamaica," by Robert T. Hill. *Bulletin of the Museum of Comparative Zoology*, Harvard College, vol. xxxiv.

The mountains are composed of friable or loosely consolidated shales, clays, and conglomerates, with here and there a local bed of limestone or an occasional dyke of igneous rock, and their present configuration is due to the readiness with which they yield to erosion. The Blue Mountains are the highest of an extensive system of corrugations which were partially buried, especially to the west of the centre of the island, during a period of subsidence, under a mantle of white limestone, and has since been re-elevated to a height of 3000 feet. The old structure and material reappear in many places in the great central valleys of St. Thomas-in-the Vale, Clarendon parish, etc., where the limestone has been worn away, and are also visible below the limestone in the face of the back coast bluffs along the western half of the north side of the island.

The geographic centre of Jamaica is marked by a most interesting topographic feature, an anticlinal valley worn out of the crest of the low arch of the white limestone plateau. An elongated oval, fifty miles in length, mostly in Clarendon parish, this great amphitheatre is surrounded on all sides by the inward-facing breaks of the limestone, which rise 2558 feet on the south and 3000 feet on the west side. Most of the area of the valley is occupied by two parallel ridges, with laterals and outliers. The northern, dividing the Minho from the St. Thomas river, is known as the Main ridge; the other, parting the basin of the Minho from the Cave and Pindar rivers, which may be called the Santa Maria ridge, culminates in Bull Head. These ridges consist of the same material as the Blue Mountains, trend also northwards, but are not so serrated. The heights of these mountains (Bull Head, 2885 feet, and the Main ridge, 2542 feet) nowhere exceed that of the limestone plateau. They are modern drainage divides, and were at one time completely covered by the limestone. In the south-east corner of Hanover parish, in the valley of Great river, and at Jerusalem mountain, in the north central portion of Westmoreland, the central mountain rocks are also exposed by denudation.

This structure is intensely folded. In the east it is a crumpled anticline, and has been subjected to additional disturbance by the intrusion of a great mass of granitoid porphyry, with many auxiliary dykes, which is now exposed on the north side of the west end of the ridges in St. Mary. In general all the central mountain structure occurs along three lines of strike, probably representing the outcrop of two original lines of corrugation, the ends of which overlap *en échelon*. The Blue Mountain ridge is the most northern and eastern of these old corrugations, the Clarendon and Hanover exposures an intermediate one, and the Jerusalem the most southern and western. As this structure is found in the bluffs on the north coast, it may be concluded that at one time it formed a mountainous region, covering a larger area than the whole of the present island.

The plateau region is now a much dissected plain, rising to a height of 3000 feet. Its greatest extension is to the west of the Blue Mountains, where it stretches all across the island, and, in all, it occupies fully four-fifths of the total area. Its profile, were the irregularities caused by erosion filled up, would be a gentle arch sloping north and south towards the sea, and meeting it far beyond the present margin of the land. The

edge of this plateau is in many places marked by benches and terraces constituting the back coast border. The highest summits of the plateau are found in the crests surrounding the Clarendon basin, which attain a maximum altitude of about 3000 feet, or less than one-half that of the Blue Mountain peaks. The John Crow ridge on the east (2100 feet) may be either a remnant of the old summit-level or the oldest and highest of the base-level plains cut out of its marginal topography. On the south side of the Blue Mountain ridge, the highest summit of the Yallahs mountain (2254 feet) is the only remnant of the old topography on that side of the island. Isolated remnants of the plateau, separated by the indentations of the lower-lying coastal plains, occur at Port Henderson, the Healthshire hills of St. Catherine, the Braziletto mountains, and the Portland hills of Clarendon.

The materials of the plateau are soluble limestones—old sheets of calcareous oceanic sediments now chalky or subcrystalline in texture. The hills, especially in the interior, owe their configuration largely to solution, while the forms of the central mountains are due to denudation. The summit of the plateau is a roughly serrated, hilly country indented by cockpits (sink holes), sub-circular basin valleys, and deep drainage-ways leading to the sea. The origin of this topography can be best illustrated by a description of the Cockpit Country, as it is locally called. It extends over all the higher ground to the north and west of the Clarendon ridges, though the actual cockpits are confined to the corners of the parishes of Trelawney and St. James. In the interior of the western half of the island the hills are sharply rounded conical points; towards the coast are flat-topped ridges such as the John Crow ridge, the Yallahs ridge, and many others; while table-topped elevations with steep flanks occur in parts of Westmoreland and Hanover. The cockpits vary in depth from shallow, circular basin-like depressions surrounded by low mamillary hills to deep-side sinks often 500 feet deep. These are developed in the upper part of the white limestone. Below is another white limestone, also soluble but less pervious than the former, and, below this again, nodular limestones, clays, and conglomerates of the older insoluble and impervious formation which checks the downward course of the lime-charged waters and forces them to take a horizontal direction.

When the bottoms of the cockpits reach the more resisting limestones of the second group, their perimeters begin to expand, and round or oval valleys with steep sides are formed, known in Jamaica as light-holes. As the downward process continues the lower limestone is dissected into flat-topped remnants and finally removed altogether. At the level of the older mountain material solution ceases, and the valleys expand by erosion into extensive circular enclosed basins. Furthermore, great springs of water break out at the contact of the limestones and clays, and by their erosion help to carve out the floor of these basins into miniature mountain forms, thus reviving the antecedent topography. Ultimately the barriers between the basins and the coastal drainage areas are broken through.

The many basin-shaped depressions in the plateau region constitute

some of the most interesting physiographic features of the island. They differ from one another chiefly in area and the irregularities of the relief of the bottoms, which seldom lie more than 400 feet above sea-level, while the surrounding hills rise 1200 to 2500 feet above them. The largest of these depressions are those of St. Thomas-in-the-Vale, the great vale of Clarendon, the Hector river basin in northern Manchester, and the Niagara valley along the boundary of St. Elizabeth and St. James. The valley of St. Thomas is almost circular in outline, and its floor has a diameter of ten miles. Its bottom is largely covered with old alluvium. On the west side of the valley a band of white limestone rising in a gentle arch extends for miles towards Moneague and culminates in Mount Diablo, 2500 feet above the bottom of the basin. The valley is drained by ten copious streams, the feeders of the Rio Cobre, which through the Bog Walk cañon finds its way to the sea. The Clarendon valley is 50 long by 25 broad, and is drained by the affluents of the Minho. On the north-west is the Hector river basin, separated by a low saddle. At present it has no direct outlet to the sea, but its drainage sinks into the limestones on the east. Cave valley is in a similar condition. These are only a few of such valleys lying along the central axis of the plateau. There are several others, besides smaller and less important sinks, in the western portion of the island. They are all connected phenomena and illustrate the powerful effect of solution and erosion in producing the hilly topography of the white limestone districts of Jamaica and the Tropics in general. Should the island undergo no more uplift, solution alone would entirely remove in time the white limestones now veneering the older insoluble Blue Mountain rocks. The margins of the plateau have been similarly affected.

The seaward margin has been planed away horizontally, as is shown by a study of the back coast topography, which presents a steeply sloping, mountainous front rising to an average altitude of 1200 feet along the north coast. It presents a most interesting series of ancient terrace levels, most beautifully shown on the east side of Montego bay, where six distinct benches separated by steep slopes rise in stairs above the sea. Though not as perfect as in Cuba, the Jamaica terraces record a similar geological history. The highest of the old benches is John Crow ridge, apparently a continuous horizontal plateau ending to the south-east in Big Level. On the west it is separated from the Blue Mountains by the tremendous ravine of the Rio Grande. The higher summit of Yallahs mountain, Dolphin Head (1800 feet), and other points in Hanover, may be remnants of the John Crow level. The next persistent level corresponds to an altitude of 1500 feet. It is noticeable as the long horizontal sky-line of many of the so-called mountains of which Long mountain, east of Kingston, is a type, and is largely developed on the south coast of the island, but does not appear on the north coast. The third conspicuous bench has an altitude closely approximating 1000 feet. This is the level of a great dissected plain extending along the northern side of the island west of Port Antonio and known as the North Coast ranges, and it is also well marked on the south coast. These benches at the 2100, 1500, and 1000 foot levels are connected

phenomena, and represent a distinct stage of elevation in Antillean history.

A lower group of levels occurs at altitudes of 650, 300, and 200 feet, becoming more distinct and persistent with decreasing altitude. The back coast benches have all been cut out of the land by base levelling and marine erosion, those between 700 and 2000 feet out of the white limestone during the first period of emergence from the sea, and those from 100 to 700 feet out of the old limestone matrix during a second period of emergence following on a subsidence. There is abundant evidence that old gradational terraces continue lower down upon the submerged slope of the island, and that the phenomena of the coastal plain represent veneerings of organic, littoral, and terrigenous deposits upon old erosion plains of this character.

A narrow strip of low land extends almost uninterruptedly around the island between the sea and the back coast border. This strip is composite in character, being of three types of formations, such as elevated reefs, marginal sea débris, and land alluvium. It includes benches of different height and origin, and a long and gentle slope known as the Liguanea plain. The highest of the benches, composed of sea sediments, are from 100 to 150 feet. The elevated reefs are three in number, approximating 15, 25, and 60 feet above the sea respectively. The coastal plains and slopes, covered with alluvium, are of a peculiar type, and represent old plains of erosion. They comprise extensive areas indenting the back coast topography, especially on the south side of the island. Chief among them is the Liguanea plain on which Kingston stands. It is over 25 miles long by 6 miles wide on an average, and has an area of about 200 square miles. The interior margin is over 800 feet high near Constant Springs, whence it slopes rapidly to the sea at Kingston, 6½ miles distant. The aspect of this plain is comparatively bare and sterile, its flora, including thorny cactus and acacia, presenting a striking contrast to the deciduous tropical flora of the remainder of the island. The history of the plains of the Liguanea type is a record of four distinct events:—(1) The original cutting out of the topographic matrix during a period of base levelling; (2) the filling in of the material constituting the present surface; (3) the elevation of the plains into their present position above the sea; and (4) the cutting of the modern streamways across them.

As a whole the island presents two major types of streams, one of simple autogenous rivers flowing to either coast, and the other the streams of the interior basins which have no outlet to the sea; a third and more complicated type of drainage has been produced in certain instances by the capture of the second by the first type. The rivers of the eastern third of the island flow from the Blue Mountains to the sea, in general normal to the coast. They have deep V-shaped cañons in their upper courses and great deposits of alluvium in their lower parts. In the valleys of the Liguanea type the bights occupied by the plains were once headwater amphitheatres from which the streams flowed over a wider coastal border than at present. This border was subsequently submerged, so that the original headwaters became estuaries, and finally

elevation partly reclaimed the coastal plain. The drainage of the limestone plateau is both superficial and underground. To the former system belong the older and longer streams which brought down the material now forming the coastal plain, and shorter streams, probably of later origin, which flow from the cliffs of the back coast border. The streams of the limestone plateau summit region are of a different type. Many of the streams rise from springs near the contact of the white limestone and Blue Mountain series, and after short courses disappear into the ground without any visible outlet to the sea. In many cases the headwaters of the marginal streams have captured the drainage of the interior valleys, especially the Minho, Cobre, Montego, Black river, and Great river.

The geologic formations of Jamaica belong to four great categories:—

(1) A fundamental series of stratified shales and conglomerates, tuffs and other débris of volcanic material, and, rarely, marine limestones and marls, all of which have undergone great displacements and deformation. These compose the higher mountains and the nucleus of the island structure.

(2) A series of originally derived oceanic material—marls and limestones—which rests unconformably upon, but does not completely overlap, the more elevated outcrops of the first-mentioned series.

(3) Laccoliths, dykes and sills of igneous rocks, which penetrate the first series and the lower portion of the second, and are, therefore, of later age than both.

(4) Certain deposits of alluvium, oceanic marls, and coral reef rock, which are adjacent to the present coasts and represent fringing reefs and other accretions around the island's border after it had almost attained its present area and outline.

All these series Mr. Hill describes at considerable length; here it is possible only to report a few of his general conclusions.

Of the first, or Blue Mountain, series he gives a more accurate classification than has hitherto been made, dividing it into an upper division (Eocene) represented by the Richmond beds, and a lower division (Upper Cretaceous), comprising in descending order the Minho, Ballard, Logie Green, Frankenfield, Jerusalem, and Yallahs beds. The complex folding and partial concealment render it impossible to determine the exact base of the series. The Jamaican Reports state in different places that the base of the section is composed of igneous rocks, Cretaceous limestones, and a formation termed the "Metamorphosed Series." Sawkins expresses a doubt as to the propriety of drawing a distinction between the Cretaceous and "Metamorphosed Series," the latter including strata which have merely experienced a change of structure owing to the intrusion of igneous rocks. Mr. Hill also concludes from his own observations that the "Metamorphosed Series," as a structural formation, may be dismissed from consideration. The fossiliferous Cretaceous beds seem to be local occurrences in the great and tangled series of tuffs and conglomerates, the latter of which constitute the visible base of the section. Evidence of some older or lower-lying rocks beneath the Blue Mountain series, such as are reported in Cuba and Haiti, were sought for in vain.

In nearly all the localities of the Jamaican survey the limestones have the appearance of localised beds in the midst of the general material of the Blue Mountain series, and probably, as Sawkins suggested, originally formed isolated reefs. To the bedded limestones succeed the marls, varying from fifty feet to an inch in thickness. In general these clays contain fossils which represent intermittent life colonies, which existed in periods of quiescence during the irregular deposition of the earlier part of the Blue Mountain series. Sawkins has spoken of the limestones as "forming a zone around the great nucleus of upheaval of the island." If this were so, much of the Blue Mountain series might be antecedent to these beds. But these limestones not only lie round, but are folded in, the plexus of beds constituting the highest mountains, occurring on Blue Mountain Peak as high as Abbey Green, 4200 feet above the sea.

The tuffs, igneous pebbles and boulders of the lower subdivision are composed almost entirely of hornblendic material—andesites and porphyries—which shows that this was the chief eruptive material of Jamaica during this epoch, and of which the Minho beds apparently represent the débris of the last expiring extrusion. All the beds of the subdivision are the product of active vulcanism, accompanied by the piling up and contemporaneous degradation of vast quantities of igneous material, and of short intermediate periods of quiescence when shales and marls were permitted to accumulate and sparse faunas to gain temporary foothold.

The Richmond beds are mostly black bituminous laminated clays and ferruginous sandstones, with occasional beds of loose conglomerate. The material is mostly derived from the antecedent beds of the lower division of the Blue Mountain series. The conglomerates consist of rounded pebbles of various dimensions, and in places attain a thickness of 50 feet. They are almost entirely of the same material as the lower division, but specimens of gneiss and crystalline slates have been found in them, as well as of a fine-grained granite—rocks hitherto unknown in Jamaica. The ordinary sandstone in its extension seawards becomes a promiscuous assemblage of large pebbles, six or eight inches in diameter, which indicates that some of this material came from the area to the north, now occupied by the sea.

The interpretation of the white limestones has been one of the greatest problems of Jamaican geology. They have generally been discussed by field observers under one head, but the truth is that they represent several distinct formations and ages, from Vicksburg to recent, inclusive, but that the greater portion are of old Oligocene age. The older white limestones are of the Vicksburg stage, which is placed in the Eocene by some writers, and in the Oligocene by others; the later are of Pliocene, Pleistocene, and recent age. Some writers have believed that all the white limestones are of coral reef origin, and hence have carelessly asserted that reef rocks occur in the Antilles at heights exceeding 2000 feet, whereas, except in Barbados, such rocks nowhere exceed 100 feet in altitude and thickness. In fact, the larger thicknesses of these limestones, as shown by their microscopic fossils, are neither of molluscan, coralline, nor reef rock origin, but are foraminiferal oceanic

deposits and other offshore calcareous oceanic muds composed of organic detritus laid down at depths below that at which reef rocks were formed, and in periods of geological time prior to the appearance of the modern reef-building species in the sequence. This Oceanic series, as it may be called, consists of white limestones probably aggregating 2000 feet in thickness, and occupies most of the plateau, which includes all the island under 3000 feet in altitude outside the Blue Mountain district, except the immediate coastal border.

The coastal series includes a class of formations which represent the products of events more recent in the history of the Jamaican series than those hitherto enumerated. The beds lie principally along the margin of the sea at altitudes nowhere exceeding 250 feet, the Bowden beds being the uppermost, and are deposited unconformably against the sides of an older mainland. They were all made during epochs subsequent to an epoch of elevation, whereby the white limestones of the Oceanic series, and all preceding formations, had been elevated into land, had undergone tremendous denudation, and had again suffered partial marginal subsidence. They are of four types—beds of impure marine limestone; gravel and marl; alluvium of the Kingston type; elevated coral reefs; and littoral deposits of calcareous mud, with fossils of contemporaneous origin with the elevated reef formation. In general they are analogous in their lithological character to the formations now being made around the margins of Jamaica.

The old reefs grew upon marginal terraces which, previous to their submergence, were probably wave-cut, constructional, or gradational plains, like those now seen upon the land configuration. As they successively rose to within twenty fathoms or less of the surface, the zone of coral growth, they were occupied by the polyps which constructed the reef which has since been elevated into dry land. Similar submerged plains are now occupied by growing reefs around the island. In general the old reef rock of Jamaica consists of three distinct formations, occurring at levels of 70, 25, and 10 feet (or less) respectively. The present land margin is not continuously fringed by growing reefs, but these occur in interrupted patches, alternating here and there with strips of different kinds of bottom, such as alluvial deposits opposite the mouths of rivers, shell, sand, or lagoon mud; and similar conditions prevailed during the growth of the old reefs.

It has been said above that the oldest known rocks of the island are undoubtedly rolled eruptive volcanic débris, and that no fundamental masses of plutonic crystalline rocks, granite or others, are known to occur as a previously formed basement to the sedimentary section of Jamaica. These rocks, however, are all eruptive and intrusive and in age are contemporaneous with the sedimentary rocks. The igneous rocks may be classified into three distinct categories:—(1) The andesitic (mostly hornblende) boulders, pebbles, and tuffs of the Blue Mountain series of eruptive origin from unknown vents, contemporaneously deposited with the Cretaceous sediments of the lower beds. (2) The hornblende-diorite and granitoid porphyries of the five eastern parishes of the island, constituting dykes and masses, or laccoliths, intruded

through the rocks of the Blue Mountain series, and into the Montpelier formation of the oceanic series. These rocks are of Mid-Tertiary age. (3) Eruptive amygdaloidal basalts of the Low Layton stock or volcanic neck in the north coast of Portland, also Mid-Tertiary.

There is some reason to believe that the eruption of the hornblende-andesites continued throughout the epoch of the deposition of the lower subdivision of the Blue Mountain series up to the time of the commencement of the Richmond formation, while the latter by its more regular stratification and composition, though it contains vast quantities of water-worn volcanic pebbles, indicates that a more stable period had set in. The second class of rocks are of deep-seated origin, and, as no evidence exists that they ever protruded to the surface, they probably represent a great laccolith, which in middle Oligocene times was forced upwards into the existing formations. It seems probable also that the intrusion of these rocks was associated with the elevation of the island and the progressive shallowing so evident in the ascending sequence of the white limestone, whereby they changed from the deep sea foraminiferal deposits of the Montpelier beds into more shallow limestones, and finally into the land areas which existed at the time of the peripheral deposition of the Bowden Oligocene.

At only one locality in the island is there supposed evidence of the occurrence of true volcanic rocks *in situ*, namely, at the Black Hill near Low Layton. Since the hill was examined by Brown, a tunnel for the Jamaica railway has been cut through its base; and it has been found that the igneous rocks extend down to 700 feet below the summit, and that these rocks are of the nature of a volcanic neck rather than an entirely superficial lava flow. Characteristic fossils and chalk of the Montpelier limestone in the scoriaceous cavities of the basalt indicate that the limestone was deposited contemporaneously with, or after, the basalt, and perhaps the yellow marls lying in some places almost horizontally upon it may belong to the Bowden formation of late Oligocene age. If this be so, the Low Layton rocks date from the Montpelier epoch or before, but further research is needed to settle the question. At any rate, the Low Layton "volcano" is composed of the latest igneous rocks in Jamaican history. The intrusion of these granitoid and dioritic rocks has produced extensive metamorphism of the adjacent rocks, baking the shales into hard friable slates and indurating the Cretaceous limestones.

After an examination of the palæontology of the Jamaican rocks, which yields evidence in support of his conclusions, Mr. Hill describes the evolution of the island. What part the locus of the island played in the earlier struggles between sea and land cannot be at present stated, but at all events in late Cretaceous times the crests appeared above the waters and grew more conspicuous in succeeding epochs. The nature of the oldest known rocks in Jamaica proves clearly that in late Cretaceous times volcanic eruption was active at or near the island, while the colonies of peculiar fossils imbedded at intervals in these rocks fix the time of their origin. Furthermore, the species themselves, their faunal assemblage, and the circular arrangement of the colonies round

the nuclei of the Blue Mountain and Clarendon ridges, may possibly indicate that there were several centres of this eruption. The débris was enormous, the thickness of the still remaining portion being at least 5000 feet. These volcanic outbreaks were not confined to Jamaica.

The next event in Jamaican history was the degradation of the nucleal volcanic heaps by erosion. The thickness of the resulting sediments, aggregating 1500 feet or more, attests the existence of a high pre-existing land, and the abundant plant remains show that it was covered with dense vegetation. The uniform alternations, the wide extent of the formation, and the occasional presence of marine fossils, show that the material was sorted in shallow waters. This fact, together with the presence of a few pebbles of foreign origin, the absence so far as known of any distinct estuarine deposits, and the widespread occurrence of similar formations in the West Indies, suggests the existence at that time of larger land areas in this region than the mere nucleal summits.

There is also evidence that subsidence accompanied this deposition, and that the two processes so nearly balanced that the bottom did not materially change. These events were also closely followed by folding of the strata. The older beds of the Blue Mountain series, the Cretaceous limestones and Richmond beds, are all turned up together in this complicated system of foldings, and inseparably constitute the summits of the Blue Mountain ridge, which between the altitudes of 3000 and 7325 feet now protrude 4325 feet above all the later Eocene and Oligocene formations. As the overlying strata do not exhibit such intensity of disturbance, and some of the later beds seem to lie unconformably upon the Richmond, an interruption of sedimentation and a corrugation of the strata may have taken place after the Richmond deposition period, perhaps connected with the uplifts which had far-reaching importance in Antillean history, and were accompanied by active vulcanism in the isthmian and probably in the Windward regions. If, on the other hand, this folding did not occur at this particular epoch, then the Richmond beds may mark the initiation of a great subsidence so clearly traceable in the succeeding epoch.

This subsidence was one of the most important and extensive in all Antillean history. Cañon cuttings through the collar of the limestone plateau round the peaks of the Blue Mountain structure show that the latter extends down to sea-level, and nearly everywhere to the present margin of the island. The limestone deposits of the subsidence encrust this mountainous core to a height of 3000 feet, and hence only the portion of the summits above that altitude could have been dry land when the subsidence was at its maximum. The culmination of this subsidence can be fixed by palæontologic evidence at the close of the Eocene period, Vicksburg epoch.

The next event in Jamaican history was the re-elevation of the sea and the restoration of the land to far beyond its present outline, connecting it with the island of Haiti, and possibly with the Central American region. The emergence of the island brought up a portion of the old mountainous topography encrusted by a coating 1000 feet or more of oceanic chalks. The low east and west fold through the

geographic centre of the island, which dominates this emergence, produced a gentle arch inclining north and south. Accompanying the uplift was the great intrusion of the deep-seated granitoid and dioritic rocks already mentioned, if it were not its direct cause. The higher terraces, between 1000 and 2100 feet, seem to have been formed during or immediately following this emergence epoch, and previous to the next subsidence.

This subsidence led to a contraction of the land to its present back coast borders. It was initiated by the deposition of the Bowden gravels, found only on the north and south coasts of the eastern portions of the island, and probably culminated in the deposits of the shallow marls. The amplitude of the movement was probably less than one-third that of the former subsidence, for the Bowden and Cobre beds encrust the base of the island up to a height of less than 300 feet.

Then another upward movement of 500 feet and more brought up not only the present marginal border composed of the new-made sediments of the Bowden epoch, but a now slightly submerged area towards the south, which extended at least as far as the present 500-fathom line, embracing the San Pedro banks and cays. Though accompanied by slight deformation, it was less orogenic than the upheaval of the preceding epoch. Great erosion and denudation, following on this upheaval in late Miocene or early Pliocene time, produced the surface configuration of to-day, and the country adjacent to the lower portions of the island became extensive base-levelled plains, and included what are now the submerged benches of the island, which were coated with the Kingston formation during a subsequent subsidence. At that time the middle series of terraces, 200 to 700 feet high, was cut around the coastward face of the back coast country.

Possibly there was another subsidence in late Pliocene times, when the coastal plains were submerged, and deeply indented estuaries were formed at the mouths of the great rivers. Lastly came the series of elevations which have continued up to the present time, and are marked by the terraces of reef rock at altitudes of 60, 25, and 15 feet. Similar reefs continued to grow in the adjacent waters, which may in their turn be raised above the surface. As the elevated reefs are made up entirely of existing forms, their date cannot be earlier than the close of the Pleistocene age.

Mr. Hill enters at considerable length into the question of the relations of the Jamaican formations to those of adjacent regions, and into the geological history of the Antilles in general. The Jamaica sequence, so far as it reaches backward in time, is remarkably like that of the great Antilles, and may be distinctly termed the Antillean type. In Cuba and Haiti alone of the West Indian islands (Trinidad being essentially South American) is it at all probable that Pre-Cretaceous or older rocks than in Jamaica are exposed, though it is theoretically possible that the submerged portions of all may have a Palæozoic foundation.

The final conclusions regarding Antillean history are that no land connection can be inferred between these islands and the continents in Post-Jurassic times, and that their configuration and condition in Pre-Jurassic times cannot even be surmised. There are some hypothetical

and biologic reasons for believing that the outer rim of the American Mediterranean constituted a partial or complete bridge between the continents in Jurassic times, and that the Panama bridge did not exist. The first definite evidence of the existence of the islands is found in the eruptive rocks of late Cretaceous times, and the land débris constituting the Eocene strata testifies the pre-existence of extensive Cretaceous land areas. In late Eocene and early Oligocene times a profound subsidence submerged all but the highest tips of the Antilles, and this movement extended to the margins of the surrounding continents. In late Oligocene or Miocene times a tremendous uplift connected many of the islands without, however, entirely bridging over the interval between the North and South American continents. In Miocene or early Pliocene time the islands were again severed by submergence, and assumed their present forms, which have subsequently been affected by only secondary modifications. Since then there have been intermittent periods of elevation without serious deformation, but not sufficient to restore the islands to the heights of Mid-Tertiary time. The Pleistocene movements were not uniform in all parts of the area, showing great differences of amplitude in the West Indian region, and were not harmonious with those of the North American coastal plain. The irregularities of the submerged configuration are orogenic, and not due to submerged Continental drainage systems. The elevated coral reefs of the West Indies were formed on rising lands.

Mr. Hill's work is illustrated by numerous photographs and a contoured and a geological map of the island, from the latter of which some details have been inserted in the map accompanying this number of the *Magazine*. Mr. T. Wayland Vaughan contributes an appendix on some Cretaceous and Eocene corals of Jamaica.

AN ANTHROPOLOGICAL STUDY OF CORSICA.[1]

Corsica is the northernmost of the larger Mediterranean islands, projecting from the line of the Balearic islands, Sardinia and Sicily. From Sardinia it is separated by depths not exceeding 55 fathoms, and is connected with it by a group of islets (Cavallo, Lavezzi) in the strait of Bonifacio. Off the north and west coasts the depths are great, descending to about 1600 fathoms, while on the east, between Corsica and Leghorn, the sea is nowhere deeper than 110 fathoms, though it grows rapidly deeper to the south, up to 550 fathoms. Between Corsica and the Tuscan coast the distance is 50 miles. The community of origin between Corsica and Sardinia is shown in the identity of the direction of their longitudinal axes, which make with that of the Apennine peninsula an angle of 55°. Thus the Tyrrhenian sea, shut off from the Spanish part of the Mediterranean and closed at the south by Sicily, forms a kind of inland sea which has always been of more importance to these islands than the Mediterranean without. It is

[1] *Résumé* of an article by Professor Ratzel in the *Annales de Géographie*, No. 40.

owing to its situation on this sea, as much as to the proximity of Italy, that the eastern coast of Corsica has been from early times the historic side of the island. On the north this insular rampart approaches the north of Italy; on the south it turns away from Italy, but advances towards the projecting coast of North Africa. Corsica is nearer to Italy than Sardinia; the Italian steamers make the passage from Leghorn to Bastia in six hours, while the voyage from Civita Vecchia to the Golfo degli Aranci takes ten.

The fates of Corsica and Sardinia soon took different courses, the latter island being more exposed to Iberian influence, and also in early times to that of Carthage, which never prevailed in Corsica. Its position accounts for this, for the distance from the south of Sardinia to the nearest point of Africa is little more than that from Calvi to Nice. In Roman times Sardinia was in a much more advanced state than Corsica, and it is as rich in remains of roads and inscriptions as Corsica is poor. Conquerors, merchants, and colonists have been attracted to the larger, richer, and more accessible island. The history of Corsica has been determined by its relations to the nearest part of the continent only during a few centuries, at least in historic times—from 1098, when the Pope granted it as a fief to Pisa, up to 1348 when the Genoese rule was established. What was the precise connection of the island with the old Etruscans is unknown, but at any rate Corsica was subject to the domination of Etruria only during the two centuries and a half of the Pisan supremacy.

The distance between Corsica and France, from Cap Corse to Nice, is 115 miles, or a little more than double that to the nearest part of Italy. France, then, after Italy, is the nearest of the Mediterranean countries, and since the sixteenth century her influence has been felt in the affairs of Corsica, at first only in politics, but afterwards in shaping its civilisation. France, neighbouring on the territory of Genoa, found itself drawn into competition with this State, and of this the enemies of Genoa were fully aware; Sampiero fought for France, because he perceived that France was a rival of Genoa. Close relations were established between France and Corsica by emigration and immigration and intellectual influence, and the annexation of 1769 was but the culmination of the connection which commenced in the sixteenth century with the struggles of Sampiero.

Corsica is four times farther from Spain than Italy, and between the nearest point on the coast of Catalonia there is a deep sea without islands. The traffic with Spain is very slight, a Spanish vessel occasionally taking in a cargo of wood. In past times several attempts were made to unite Corsica and Spain, but never with lasting success. Between Corsica and Africa lie Sardinia and an expanse of sea as wide as the distance from Santa Teresa to Cagliari. Sardinia has always been more African in character, for it is nearer Sicily, which in Roman times was the threshold of Africa. The Barbary pirates have, however, played their part in the history of Corsica; all the towns of the coast were fortified because of them, and watch-towers were erected on all the promontories.

It is interesting to observe the displacements of the line running from Corsica to its suzerain State. At first the direction is east-south-east, to Rome; then the line turns to the north-east, to Pisa; then north to Genoa; and finally north-north-west to Marseilles and France. Thus, this movement repeats on a small scale that of the great historic centres.

Corsica is one of the smallest of the Mediterranean islands. It is inferior in area to its nearest neighbours, Sardinia and Sicily, is a little larger than Crete and a little smaller than Cyprus. With an area of 3367 square miles it is only a sixty-oneth of the area of France and four thirty-thirds of that of Italy. It is therefore small, even for a Mediterranean country, and this smallness has contributed to keep it in a state of dependence, which has arisen principally from its imperfect insularity. Corsica is an island, but an island in a confined part of the Mediterranean close to other islands and countries, and it has consequently been repeatedly exposed to the influence and even the attacks of its neighbours. While their insular position has assured the isolation of the Corsicans, it has not availed to maintain their complete independence. The conditions of space came into play, to the detriment of Corsica; when the narrow strip on the east coast was occupied by the enemy, it was only in the mountains that freedom could be preserved.

But, though the situation of the island has not proved sufficiently strong to exclude foreign interference in its history, the Corsicans are at any rate undoubtedly insular in their mode of life and ideas. The observers of antiquity remarked on their distinctive character, and whether for better or worse they have remained a people apart from their neighbours. While they are divided among themselves into communities, each occupying a valley in the mountains, they have been as a whole closed in by the sea. The Corsicans have not only retained their ancient manners and customs; they remain even in the present age of frequent intercommunication one of the most pronounced of insular peoples. They have succeeded in excluding modern innovation from their island, and have shown a firm resolve to adhere to their own manner of life, whatever changes may take place in the outer world, and proudly point out that Corsica has been of all the departments of France the least affected by changes of government since the revolution.

The tendency to expansion, so often noticeable among insular peoples, is also conspicuous among the Corsicans, considered as individuals. In this respect they are pure Ligurians, and show the same preference for certain countries—South America and the West Indies. But they do not emigrate as sailors or fishermen, but as small traders. The sea has no attractions for them; even in ancient times navigation and fisheries were neglected, and at the present day few Corsicans are seafarers. The foreign colonies of Phocæans and Romans, Pisans and Genoese, slightly modified this state of affairs, but their towns were always alien settlements, and are essentially such at the present day; the inhabitants of Bonifacio and Bastia are regarded as strangers by the other Corsicans.

Such a land, in its concentration and isolation, is favourable to the growth of social and political equality. It gives rise to the reciprocal reactions of land and sea which have given Corsica its striking

originality. The mountaineer descends to the market towns to sell his freshly killed lamb and goat cheese side by side with the Italian fisherman, and the wind from the mountains bears the aromatic perfume of the *maquis* into the streets of the coast towns. On the western side the granitic mountains are in direct contact with the sea, and the mountain element preponderates. Here Corsica is represented by the rock and the heath, the shepherd and his flock. On the east there is a level coastal zone; but even here the history of Corsica has been developed in the mountains. It may then well be said that among the insular traits of Corsica the most conspicuous are its separation from the outer world, the independence and peculiarities of a mountainous land.

In the structure of Corsica granite distinctly predominates, occupying two-thirds of the area and extending into Sardinia. Its axis runs from north-west to south-east, leaving on the south-west granites and other rocks of the same group, while to the north-east the island is for the most part formed of crystalline schists overlaid by a few deposits of more recent age. As the highest summits of the island are ranged parallel to and at a short distance from it, and as this frontier line is marked by a depression that is very remarkable in relation to the structure of the country, it has played an important part in history down to the very recent date of railway construction. Moreover, the few sedimentary deposits follow the same line and indicate that at an epoch when Corsica was less elevated a sea connection occupied this site. A subsidence of 2000 feet would bring into existence a strait six to nine miles wide, dividing the island into two parts, one on the north-east and the other on the south-west.

At first sight the relief of Corsica seems to be entirely dominated by a chain of mountains, constituting also the watershed, which runs from the most northern point almost to the southern extremity, and divides the island into eastern and western halves. Numerous ridges run out east and west from the main chain, divided by more than thirty valleys, and this parcelling out of the land is the more perfect, where, as on the western side, the mountains reach down to the sea, hemming in the most strictly closed districts of the island, the most independent of the sixty and odd *Pievi* into which Corsica is divided. As the line of the watershed is very sinuous, lying nearer to the east coast in the south and nearer to the west coast in the north, the natural cantons determined by the lateral ridges are of very variable area. The largest are the basins of the Golo and Tavignano, to which may be added that of the Orbo. The three together constitute the largest continuous extent of open country in the island and the most important in its history. On the other hand, the smallest communities are in the deep valleys of the south-east and north-west.

The mean height of the passes in the main granitic chain may be estimated at 4300 feet, but the road Ajaccio-Corte-Bastia crosses by the Col de Vizzavona, only 3800 feet, a fact of great importance to Ajaccio as the political capital. A still more important fact in the history of the island is that the passes decrease in height towards the north-west, admitting of freer communication than is possible in the south, and

hence the north-west, with Saint Florent and Calvi, make an integral part of the north-east, whereas the cantons south of the valleys of the Orbo and Gravone remained for a long time shut off from one another. This difference of altitude in the passes of the chain is due to the intersection of the backbone of the island with the great geological boundary between the granitic region on the south and west, and the schistose region of the north and east. The close proximity of the depression between the granites and schists and the direction of the principal lines of relief, which are nowhere more than twenty miles from each other, has caused an intimate connection between the highlands and population of the interior, the centres of traffic and the chief routes, and hence the constant interference of the mountaineers in the history of the island. The limit between the north-east and north-west regions gains in importance by being intersected obliquely by the depression, which affords a passage to several sections of routes.

On the north-east of this line the surface consists of undulating elevations stretching in parallel lines from north to south, and then curving towards the south-east. The most important of these forms the peninsula of Cap Corse, and culminates in a peak only 4300 feet above sea-level, though it nowhere descends lower than 3100 feet. Where the peninsula is attached to the main mass of the island, however, summits and crest become lower, the Col de Teghime, between Bastia and Saint Florent, being only 1770 feet high. Very different is the granitic side of Corsica. Valleys running south-west and terminating in gulfs are hemmed in by spurs of the main chain which can with difficulty be crossed near the coast. To pass from Ajaccio to the Gulf of Sagone an elevation of 1360 feet must be reached, and 1640 is the lowest passage thence to the Gulf of Porto. This region, therefore, has always been least affected by great social and political movements and convulsions.

The narrow tongue of land called Cap Corse is also, in consequence of difference of structure, an island in itself. Here also the spurs of the dorsal chain have given rise to numerous small communities, each with its separate outlet to the sea. But as the land is fertile, and has long been noted for its excellent wine, it has maintained constant intercourse with Genoa, and, owing to this fact, its inhabitants have been regarded with no great favour by the other Corsicans. Vendetta and brigandage died out in early times, and emigration, often followed by the return of the emigrants, has modified the character of the people, and has rendered Cap Corse the wealthiest, or more correctly the only wealthy, part of Corsica. Nebbio, the district round the Gulf of Saint Florent, has been the theatre of decisive combats, because it is situated at the crossing of the route from Cap Corse to the centre of the island with that which connects the eastern and western coasts by the Col de Teghime.

The country south of the road between the Gulf of Porto Vecchio and the Port de Figari is for the most part an alien appendage to Corsica. This country of Bonifacio is composed of calcareous rocks of recent origin, and the surface is a low moor with yellowish herbage, for the strong winds prevent trees from growing, and the soil is not favourable

to brushwood. It is in this corner of the island that the Genoese first obtained a footing, and founded one of their colonies.

The district which has been most prominent in history is that east of the dorsal chain between Bastia and the Solenzara river, in which lies the Terra de Commune, extending from Aleria to Calvi, and from Brando at the base of Cap Corse to the main range. Gregorovius says of the people of the Terra de Commune that they have always firmly united throughout the vicissitudes of Corsican history, and that they really form the Corsican people. But the power of resistance must not be forgotten with which the shepherds of the south and west supported the Terra de Commune; though taking little part in open struggles they have clung with the greater tenacity to their ancient customs and ancient rights. The Terra de Commune, besides being connected with the sea by the largest rivers of the island, has also the advantage of the lofty mountain barrier in its rear. It includes, among several others, the small canton of Niolo, the upper basin of the Golo, where a population composed almost exclusively of shepherds have retained the primitive manners of Corsica. They are a hard-working people, and patiently till the most elevated and least productive soil of the island, while many of the lower and most fertile lands are abandoned to the *maquis*.

Corte, on the threshold between the Golo and Tavignano, was the political centre of the island in the eighteenth century. It not only unites the two principal valleys, but is also the centre of roads diverging to the different coasts of the islands. The Tavignano road is, perhaps, one of the oldest from the coast to the interior, and as long as Aleria was the principal port, it was by this route that all attempts to connect the east coast with the interior were made. The railway has now diverted the traffic to the Golo valley.

A whole series of historical sites are included in this north-eastern district; on the lower Golo is Borgo, where the Corsicans twice repulsed the Genoese and the French when they tried to penetrate into the interior; farther up the river, at Ponte Nuovo, the Corsicans yielded up their liberty and independence to the French on May 15th, 1769; and the names of many other places in the neighbourhood occur in the annals of Corsica.

All the west coast of the island is abrupt, from Cap Corse to Cap Pertusato. On the east the coast is abrupt only from Cap Corse to the northern margin of the lagoon of Biguglia, and from Cap Pertusato to the silted-up mouth of the river Travo. There remains, therefore, a level coastal strip, including the plains of Aleria, of Vescovato, and of the lagoon of Biguglia, where there is everywhere a foreshore, and the roads and railways run at a certain distance from the sea. This strip is only an eighth of the total coast-line. A comparison with the west coast proves that the effect of a coast on the progress and civilisation of a country cannot be measured by its length alone. The deeply indented western coast, abundantly provided with gulfs and peninsulas, has a length in proportion to that of the east coast as 12 : 5.

The western coast, in spite of its intricate articulation, has shown in its history none of the advantages that its configuration ought theoreti-

cally to present. It does not bring a large number of the inhabitants into contact with the sea, nor has it given rise to the contrasts so favourable to civilisation. None of the deep gulfs had a port of any consequence before Ajaccio became the capital of the island. The Gulf of Ajaccio is the most articulated in Corsica, and has a coast-line of 32 miles. But Ajaccio owes its prosperity not to its gulf, but to its position with regard to the interior, the fertility of the neighbourhood, and, more than all, to political circumstances. On the other gulfs there are only small hamlets, Propriano alone, on the Gulf of Valinco, having more than 1000 inhabitants. Each of the four large gulfs contained within the short space of 50 miles has its landing-place, but in all protective works are necessary, as the gulfs open wide towards the west or south-west. The Gulf of Ajaccio alone has a sufficient depth of water to allow sea-going steamers to draw up alongside the quays. Of all the ports of Corsica the best is Porto Vecchio, but it has no *hinterland*; and it is owing to the vicinity of the most accessible and richest part of the island that Bastia has become the chief port. The principle which Ritter first sought to establish, that the longer the coasts in proportion to the area, the more favourable are the conditions for the progress of civilisation, does not seem to be exemplified in Corsica.

The total coast-line of Corsica measures 435 miles, and omitting the smaller sinuosities, there is a mile for every 12 square miles of the area of the island, so that all the districts except Niolo are more or less connected with the sea.

The opposition between the coast and the interior cannot in so small an island give rise to lasting ethnical distinctions. Whenever danger threatens the coast the inhabitants retire to the mountains; they fled in former times from the attacks of corsairs, and now they take refuge temporarily from malaria in the more heathy highlands.

The effect of the coast, then, lies not in its length but in its character. For 58 miles, from the Solenzara to Bastia, the east coast is low, and depths of 30 feet are in many places not found nearer than half a mile from the land, while the 27-fathom line is often 3½ miles distant. Here, too, the land slopes most gradually towards the mountains, and vast deltaic formations have contributed to render the outline of the coast uniform and rectilinear. The parts of the coasts that are abrupt are *rias* coasts of a very pronounced character, and besides those coasts where the rias are cut entirely in the granite rocks, there is a short section of the west coast, from Punta d'Eccica to Bonifacio, where the furrows are smaller and less deep, but more closely packed, presenting the character of a rias coast on a reduced scale. While on this coast the mountain chains terminate in an oblique line on the coast, in the north, from Bastia to Cap Corse and from Cap Corse to Saint Florent, the folds present their flanks to the sea. This section of the coast is about 60 miles long, so that rather more than two-thirds of the Corsican littoral are occupied by the rocky and indented coasts of the rias. On the east the railway has been constructed without difficulty, but if the gulfs of the west coast are ever connected by railways, it must be through the interior of the country, where the roads now run.

A circumstance may be alluded to which seems to be connected with the rockiness of the Corsican coast. All the megalithic monuments are situated on the western slope, near the sea. None has been discovered on the east coast. The dolmens are placed in sight of the sea, and in regions where granite blocks are strewn about on the ground.

THE NEW ATLAS OF METEOROLOGY.[1]

EDINBURGH is to be congratulated on being the centre from which is to emanate that monument of laborious research, *The Royal Physical Atlas*, of which the first instalment, *The Atlas of Meteorology*, is before us. Twelve years have now elapsed since the appearance of Dr. Hann's *Atlas der Meteorologie* (Berghaus), in which our then existing knowledge of the subject was graphically shown on twelve plates with nearly sixty maps. Since the publication of Dr. Hann's *Atlas*, great progress has been made, not only in the increase of observing-stations, but in the number of specialists engaged in working up the accumulated masses of meteorological statistics. The present volume, accordingly, takes a much wider range, containing no less than four hundred charmingly executed maps, produced on thirty-four plates. The results here exhibited have been gathered from hundreds of widely scattered sources, besides embodying much of the original work done by Dr. Buchan, who has throughout given the collaborators the benefit of his counsel and advice. Prof. Hann and other leading authorities have also lent their aid, and no effort has been spared to make the *Atlas* as complete and representative as possible. The compilation of the data represented on the entirely new maps, of which there is a large number, must have involved an immense amount of labour. Dr. Herbertson, on whom the brunt of this heavy work has fallen, is in every way to be congratulated on the efficient manner in which he has handled the vast masses of material dealt with.

The maps contained in the *Atlas* have been grouped under two heads—Climate and Weather. Those dealing with climate give in graphic form the monthly and annual distribution of the climatic elements over the globe, thus providing a sufficiently broad and sound basis for meteorology to work out interesting and useful results. Of these maps the more important are those dealing with pressure, temperature, winds, cloud, rainfall, and sunshine. For countries where the stations are sufficiently numerous, large-scale maps have been drawn, from which the effect of the various orographical features may be approximately ascertained. Characteristic weather types are shown in a series of maps illustrating the meteorological conditions prevailing at given periods over well-defined areas. To exhaustively detail

[1] Bartholomew's *Physical Atlas*. Volume iii. *Atlas of Meteorology*. Prepared by J. G. Bartholomew, F.R.S.E. and A. J. Herbertson, Ph.D., and edited by Alex. Buchan, LL.D., F.R.S.

every feature of the work before us would far exceed all reasonable limits, but it will probably afford the best general idea of its scope and utility if we give a brief summary of a few of the leading features.

In the introduction, which comes from the able pen of Dr. Buchan, we have presented to us a concise and instructive summary of the gradual development of meteorology along with a terse exposition of some of its most recondite principles. The position of meteorology, viewed in connection with the geographical distribution of results, is practically unique and without a concurrent; for, as pointed out by Dr. Buchan, none of the other sciences, such as geology or biology, can compete with it in this respect. This gratifying condition of the science is due in no small measure to the laborious and self-denying labours of thousands of painstaking observers in all parts of the globe. The estimated number of stations where meteorological observations are made is 31,000. Of these 380 are first-order stations, where hourly observations of the principal climatic elements are made day and night, either by means of eye observations, as at the Ben Nevis Observatory, or by photographic and other mechanical methods, as at Kew and Greenwich. The results from these stations are all-important in giving data for the calculation of the diurnal range of barometric pressure, temperature, rainfall, etc., whereby the sequence of meteorological phenomena attending the daily revolution of the globe on its axis may be determined. Of the second-order stations there are 2620; at these stations observations are taken twice or three times a day, and the results transmitted weekly or monthly to the various weather bureaus. At the third-order stations, numbering 6600, observations are taken only once a day, while there are 19,400 rainfall stations where that element of climate alone is recorded. The distribution of these stations over the globe is graphically shown in the Frontispiece, and a glance at it is sufficient to show how extremely inadequate the representation is over large areas of the earth's surface. More stations are urgently required in South America to the south of the Argentine Republic, the subarctic regions of Canada and Siberia, and large tracts in South Africa to the north of Cape Colony. The representation is also far from complete in China, Siam, and south-west Asia and in Antarctica. On the other hand, there are large numbers of observing-stations in the British Isles, Denmark, and Saxony, while Mauritius and Jamaica are well equipped with observers. It is therefore evident that much yet remains to be done in still further extending the network of stations over our terrestrial sphere.

The maps showing the distribution of temperature, pressure, and rainfall are remarkably complete and instructive. The world maps of annual temperature are based on seventeen million observations, and those of pressure on at least fourteen million observations, derived from data recorded for fifteen years at 1539 and 1280 land stations respectively. The isobaric maps exhibit in the clearest manner the way in which the earth's atmosphere is distributed from month to month over the globe. Since the geographical distribution of pressure determines the direction and force of the prevailing winds, the intimate inter-relations which exist between pressure, temperature, humidity, sunshine,

and rain can be studied and determined. The maps further show the influence of the prevailing winds in determining the rainfall of any particular region, the precipitation being great where large masses of warm air are transferred by the prevailing air currents to regions where lower temperatures prevail, the rainfall being excessive in those districts where a mountainous ridge intercepts the warm air from oceanic regions, as in the West Highlands of Scotland, on the west coast of Norway, and along the eastern side of Asia. On the other hand, small rainfalls are recorded in those regions where the prevailing winds have not blown over large expanses of water, or where they advance into lower latitudes, thereby becoming arid and desiccating. The other maps dealing with anomalous and typical weather and storms are particularly interesting. They show in the clearest manner the all-powerful influence of the distribution of barometric pressure in determining hot and cold months and seasons in different regions, as well as the course taken by storms in various parts of the world. In these maps the fundamental principles underlying weather-forecasting are further exemplified, and much light thrown on the apparently capricious course taken by storms from day to day. The work is provided with a critical bibliography, a glossary of meteorological terms, comparative tables, and an index. These are but a few of the details which must make this, the first portion of *The Royal Physical Atlas*, stand out to all future time as one of the most elaborate and beautiful consummations of nineteenth century cartography.

R. C. M.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Meeting of Council.

A meeting was held on November 14th, when the following ladies and gentlemen were elected members of the Society :—

Farquharson, Miss A.
Horsbrugh, Miss J.
MacGeorge, Mrs.
Maclagan, Mrs. Douglas P.
Pellatt, Miss.
Raimes, Miss E. C.
Reid, Mrs. D.
Sikes, Miss S. K.
Walker, Miss M. R.
Watson, Mrs.
White, Miss A. N.
Cook, G. M.
Dalgleish, Hugh R.
Dobson, W. S.
Gibson, Andrew.
Gunn, Joseph J.
Johnston, Colonel D. A., R.E.
Kemp, John, M.A.
Laird, D. P.
Lander, T. Eaton.
Lennox, Hugh.
M'Vitie, Robert.
Milne, Dr. A. D.
Miller, W. E.
Miller, Dr. W. H.
Morrison, Donald.
Munro, J. Gordon.
Murdoch, W. G. Burn.
Paull, J. G., M.A.
Pillans, W. S.

Ritchie, Chas.
Sikes, Louis.
Stalker, R. B.
Stuart, Wm.
Tod, Dr. John.
Turner, A. Crosbie.
Watt, A. T., M.A., B.L.
Watt, Jas., M.A.
Weir, Jas. M.
Wemyss, Baillie.
—In all forty.

The following gentlemen were elected Corresponding Members for the session. 1899-1900 :—

Anderson, R. Hay, Esq., . . *Mexico*
Angus, H. Crawford, Esq., *Nyassaland*
Ballivian, Don M. V., . . *Bolivia*
Bell, Dr. Robert, . . . *Canada*
Bodio, Prof. Luigi, . . . *Rome*
Chaix, Prof. Paul, . . . *Geneva*
Corstorphine, Professor, *Cape Town*
Dingelstedt, Mons. V., . . *Geneva*
Harrington, Mark W., Esq., *Washington State*
Johnston-Lavis, Dr., . . *Monaco*
Margerie, Mons. de, . . *Paris*
Mason, W. B., Esq., . . *Japan*
Mello, Prof. Carlos de, . . *Lisbon*
Mohn, Prof. H., . . *Christiania*
Penck, Prof. A., . . . *Vienna*
Pilgrim, Dr. E. Graham, *Buenos Aires*
Pittier, Professor, . . *Costa Rica*
Preece, J. R., Esq., H.B.M. Consul, *Ispahan*
Routledge, R. M., Esq., . *Trinidad*
Russell, Prof. I. C., . *Michigan*
Steffen, Dr. Hans, . . . *Chile*
Suess, Professor, . . . *Vienna*
Thomson, J. P., Esq., . . *Brisbane*
Wagner, Prof. H., . . *Göttingen*
Wild, Dr. J. J., . . *Melbourne*
Woodford, C. M., Esq. *Pacific Islands*
Yate, Major A. C., . *Baluchistan*

Mr. A. Crosbie Turner was appointed an additional Hon. Secretary of the Glasgow Branch.

The Annual Business Meeting

was held on the same day in the Society's Hall. Professor James Geikie presided.

Sir John Murray, K.C.B., was elected President of the Society in the room of the Marquis of Lothian, who has occupied the Chair for five years. The Vice-Presidents were re-elected, and the Marquis of Lothian was added to their number. Professor Butcher was elected a trustee in the place of the late Mr. Robert Cox, M.P., and the other office-bearers were re-appointed.

General Dalmahoy, Mr. J. R. Reid, Mr. G. W. Baxter, and Mr. Andrew Coats, who were appointed temporary Members of Council since the date of the last business meeting, were confirmed in their appointments.

Of the twenty Members of Council, who retire by rotation, the following twelve were re-elected :—Dr. John Kerr, Mr. Paul Rottenburg, the Rev. Dr. W. Ewen, Mr. I. J. Weinberg, Colonel Caddell, Dr. D. F. Lowe, Professor Ralph Copeland, Captain Hamilton Dunlop, Dr. J. J. Rogerson, Mr. Victor Fraenkl, Dr. George Smith, and Mr. W. B. Blaikie.

To fill up vacancies, the following gentlemen were elected Members of Council: —Mr. R. A. Lockhart, Sir James A. Russell, Mr. James Currie, Jun., Mr. H. G. Younger, Lord Kinnear, Colonel James Sconce, Mr. Robert Blyth, Colonel Cowan (in the place of Dr. Herbertson, who resigns), and Mr. Alex. Mackay.

The *Report*, which is printed at the end of this number of the *Magazine*, was adopted.

Meetings held in November.

The anniversary meeting at Edinburgh was held in the M'Ewan Hall, on the evening of November 16th, when the new President of the Society, Sir John

Murray, K.C.B., took the Chair, and Lord Charles Beresford, M.P., delivered an address on "The Far East." A vote of thanks to Lord Charles Beresford was moved by Sir Lewis M'Iver, M.P., and seconded by Captain Russell of H.M.S. *Rodney*.

The Glasgow Branch held its anniversary meeting on November 22nd, the Rev. Dr. Ewen presiding. The subject of the lecture, delivered by Professor G. A. Smith, D.D., was "The United States of To-day." Mr. Blyth moved a vote of thanks to Professor Smith.

On November 15th, the Rev. James Scott, of Natal, lectured to the Dundee Branch on "South Africa, Past and Present." On the motion of Mr. Buist, a hearty vote of thanks was given to Mr. Scott, and Mr. R. B. Don, who presided, was thanked on the motion of Mr. Garriock.

Mr. Scott also addressed the Aberdeen Branch on November 14th. Mr. James Spence occupied the Chair. Lord Provost Fleming moved a vote of thanks to Mr. Scott, and Mr. J. Bryce, M.P., in moving a vote of thanks to the chairman, spoke of the great services Mr. Spence had rendered to the Society's Branch in Aberdeen.

On November 30th, Mr. Scott lectured on "The Boers and the Seat of War in Natal," in the Society's Hall in Edinburgh. General Dalmahoy presided.

Lectures in December.

A meeting will be held in Edinburgh on December 14th, when Mr. O. H. Howarth will read a paper on his explorations in Western Oaxaca, Mexico.

At Glasgow, Mr. J. Y. Simpson will lecture on December 11th, his subject being "The New Siberia."

Mr. Simpson will also deliver a lecture at Dundee on December 12th.

GEOGRAPHICAL NOTES.

By The Acting Editor.

EUROPE.

Anglo-German Agreement.—An agreement has been arranged by which Great Britain resigns her rights in the Samoa islands, which are divided between Germany and the United States, the latter retaining the island of Tutuila and the other islands of the group east of 171° E. long. Germany renounces in favour of Great Britain all rights over the Tonga islands, including the Vavau group and Savage island, and transfers to her the islands of the Solomon group east and south-east of Bougainville and Buka, that is, Choiseul and Isabel with the surrounding islets, including the Howe group. The neutral zone lying between the Gold Coast and Togoland is to be divided between the two Powers, the river Daka being taken as the boundary up to the 9th parallel of latitude, from which point northwards the exact boundary is to be fixed by a commission. It is, however, provided that the Mamprusi and Gambaga countries shall belong to Great Britain, and Yendi and Chakosi to Germany. Lastly, Germany consents to abandon its extra-territorial rights in Zanzibar, which it holds until the expiration of the present commercial treaty in 1902, whenever other nations abandon theirs. The assent of the United States is considered certain.

Iceland.—The Langsjökull was explored last year by Th. Thoroddsen, and this year it has been ascended for the first time, by Mr. F. W. W. Howell and two companions. The glacier region was entered from the western of the two lakes

which lie in the Flosaskardh valley between the Eiriks and Langsjökull. On August 3rd, the climbers continued the ascent in a north-easterly direction, and camped for the night at the foot of a cone of tuff, which rises above the ice to the north of Hvitárvatn, and is begirt on the north-east side by a hollow in the ice one hundred and fifty feet deep and as much across, probably the work of rays of the sun reflected from the cone. The descent was made over steeply sloping glaciers, and the plain was reached to the north-east of the Hrutafell glacier. The view from the summit was very fine, extending to the Snæfell and Vatnajökull.

The latter reaches its greatest height, 6426 feet, in the Öræfajökul, which is also the culminating point of the whole island. A doctor, Svein Pálsson, ascended the mountain in last century, but reached only the peak named Knappr, 6240 feet. The highest point, Hvannadalshnukor, was first attained by Mr. Howell, in 1891. This year a young Danish doctor, Chr. Schierbeck, started along Howell's route, but finding it impracticable except in quite clear weather, had to look for another. On June 30th, he left with Howell's guides, the manse of Sandfell, and at a height of 800 to 1000 feet came to a cave beside which ranunculus, violets, and stonecrop were growing with the ice all around them. Innumerable cascades and brooklets leap from the glacier walls, one just opposite the cave being more than 1000 feet high. Leaving all but the most indispensable baggage in the cave, the climbers made for the summit, which they reached in five and a half hours, in spite of a snowstorm and $5\frac{1}{2}°$ of frost.—*Globus*, Bd. lxxvi. No. 17.

Proposed Observatory on Mount Elbrus.—In May last Mr. I. V. Poggenpol lectured before the Geographical Society of St. Petersburg on a suitable site in the Caucasus and the excursions he made in 1897 and 1898 to explore the ground. After a purview of the high-level stations in Europe and America, in which he omitted all mention of that on Ben Nevis, he observed that the Caucasus, forming a huge barrier between the Black and Caspian seas, was an exceptionally favourable position for meteorological observations, and also for the investigation of glaciers. The greatest extent of glaciers lies on Mount Elbrus, not less than 96 square miles in area, and those on the western side have been less thoroughly investigated than those on the south-east, east, and north. In September 1897 M. Poggenpol travelled through Svanetia and over the Donguzorun pass to the valley of the Baksan. Though suddenly caught in a very violent snowstorm, during which he lost part of his baggage in the crevasses of the Donguzorun glacier, and without the warm clothing necessary for an ascent of Mount Elbrus, he nevertheless succeeded in making a prolonged excursion along the ridge between the Terskol and Gara-bashi glaciers, and noticed that close to the very crest of the ridge adjoining the glacial mantle there was a level patch of ground, covered with snow of no great depth apparently, which would be very suitable for the erection of a hut. A snowstorm prevented M. Poggenpol from approaching the spot on this occasion, but in August 1898 he was sent out again by the Russian Geographical Society to continue his investigations. By the valley of the Baksan he reached a small lake in a hollow a little below the ridge, where he formed a camp. Then he ascended to the small plateau lying between the Gara-bashi and Terskol glaciers. It stands 12,300 feet above sea-level, and has a length of 700 feet. On the south it is bounded by the rocks of the crest, on the north adjoins an ice-field which falls gently to the Gara-bashi and Terskol glaciers. It is covered with snow varying from nine inches to a foot in depth. The erection of a meteorological station on this site would present no difficulty, as the snow might easily be cleared away and a foundation laid of blocks of trachyte and porphyry which are close at hand.

Calm weather does not last for more than three or four days at a time, and, therefore, to build a shelter of stone would be a very troublesome task. One of wood carried up the mountain in sections ready to put together would be preferable. M. Poggenpol proposes that it should contain three rooms—a kitchen and living room for travellers, and a third for the instruments. Prince Nauruz Urusbief, who is much interested in the undertaking, would have charge of the key of the building.

Not content with the discovery of such a suitable site, M. Poggenpol determined to inquire into the possibility of erecting another station on the saddle between the twin summits of Mount Elbrus. Accordingly he set out at midnight with several attendants, and with considerable difficulty climbed up the slope of the eastern summit over glaciers, huge crevasses, and rock, experiencing much inconvenience from the rarity of the air, and reached the saddle between the summits at a height of 17,500 feet. He even made an attempt to scale the western peak, though the wind, which had been rising all day, had become very violent, and the thermometer had sunk nearly to zero. Having, however, ascended to a height of 18,200 feet (the height of the peak is 18,470 feet), he thought it prudent to turn back, as it was after four o'clock, lest he and his party should be overtaken by the darkness while still far up on the glaciers. He concluded that owing to the difficulty of working at such altitudes the erection of a small observatory on the saddle is impossible until some intermediate shelters exist.—*Izvestiya* of the I. R. Geogr. Soc., No. 2, 1889.

AFRICA.

Fez.—Dr. F. Weisgerber has made a journey into the interior of Morocco, traversing some hundreds of miles never surveyed, and visiting some places never or seldom reached by Europeans, and during a sojourn of six weeks at Fez drew up a very complete plan of the town. Fez, properly Fas, is composed of two distinct towns, Fas ej-Jedid and Fas el-Bali, distant about a third of a mile from each other, but connected by Bu-Gelud, which may be considered a suburb of Fas el-Bali. From the south-west corner of Fas ej-Jedid to the north-east corner of Fas el-Bali the town measures about two and one-sixth miles. Fas ej-Jedid is situated at the north-eastern corner of a large plain, which rises gently towards Mekinez, bounded on the north by Jebel Terrat, the mountains of Muleh Yacub and of Zarhun, on the south by the Beni Mtir. The Wed Fas, coming from the plain, directs its course to this angle and enters a valley at first narrow but expanding as it approaches the Sebu. It is in the narrowest part of this valley that Bu-Gelud and Fas el-Bali are situated. To the north-east of Fas el-Bali stands Jebel Salag, the highest elevation in the immediate neighbourhood. On the south the mountains gradually rise towards Sfru. The Fas rises in the west-south-west at a distance of about seven and a half miles, one and a half miles south of the route from Fas to Mekinez. At this place, called Ras el-Ma (the water head) several subterranean streams unite in a limestone basin. The Fas skirts the northern side of Fas ej-Jedid, and, after furnishing motive power to an arms factory, divides into three branches, which supply the mosques, public fountains, and baths of Fas el-Bali, and, re-united, issue from the town under the name of the Wed Bu-Khararb. About two and three-quarter miles below the town the river enters the Sebu after a total course of twelve and a half miles, during which it falls 673 feet. Fas ej-Jedid is supplied with water from the aïn Bu-Amir by an aqueduct three-quarters of a mile long.—*Comptes Rendus* of the Paris Geogr. Soc., No. 6.

The Bangweolo Region.—A short account of Mr. Weatherley's most recent explorations is published in the *Geographical Journal* for November. From

Chita, on Lake Mweru, Mr. Weatherley crossed the plateau and descending to the Johnston falls on the Luapula proceeded to the north-west corner of Bangweolo. The Mwampanda, Lifubu, and Liposori, three considerable rivers, form a marsh some ten miles north-west of the lake, called Kasamba, whence they enter the lake by a waterway called the Sanga. The north end of Bangweolo is in lat. 10° 48′ 4″ S., and the exit of the Luapula at Panta point in lat. 11° 31′ 32″ S., so that the length of the lake is 43½ miles.

After surveying the islands Kirui, Kisi, and Mbawala, finding depths in the intervening channels of 12 feet 6 inches to 15 feet, he crossed the Ifunge peninsula, which he formerly considered to be an isthmus, and surveyed the small lake Chifunawule, 5400 yards across at its southern end. He then returned to Bangweolo and attempted to descend the Luapula, but found it blocked with sudd. He therefore had his boats dragged across the densely wooded peninsula of Kapata to the Kampolombo lake, which he surveyed. Another attempt, equally unsuccessful, was made to navigate the Luapula, nor was it possible to proceed westwards to the Kangwena, a small round sheet of water connected with Kampolombo by the channel Wutuwa. Kampolombo, 3½ to 4 miles across, was navigated in a furious storm, and a camp pitched on the peninsula separating it from Chifungwe, a narrow sheet of water abreast of the northern half of Kampolombo. Thence the expedition struck overland to the Luapula, and from Kafufwe, in lat. 12° 8′ 52″ S., Mr. Weatherley followed every bend of the river down to Lake Mweru. The Mumbotuta falls, which no white man had ever visited, are due to a fault cutting the river diagonally, and present a grand sight. The greater part of the river above the Johnston falls is quite unnavigable. These falls, a succession of rapids and cataracts, extend from 10° 46′ to 10° 33′ S. The whole country west from the Mwyangashe river to about 10° 18′ S. is called Ukanda. The most southern point of Mweru is in 9° 31′ 7″ S., but the Luapula entrance is some miles further north. Mr. Weatherley insists that Bangweulu is the correct spelling of the name.

Between the Omo and Sobat.—A Russian traveller, Mr. A. K. Bulatovich, travelled in 1898 across Jimma and Kaffa to the Omo, traversing some parts of the country that had not previously been visited by a European. On January 8th he arrived at Andrachi, at the confluence of the rivers Gumi and Gicha (which form the Dincha), the capital of Kaffa and the residence of Walde Giorgis, the governor-general of the south-western provinces of Abyssinia. Kaffa lies on the crest and slopes of a lofty chain running towards the south-west, which has an average height of 7900 feet, while some of its summits attain to 10,000 feet. On January 16, M. Bulatovich left Andrachi, travelling westwards and ascending to the ridge, which he followed southwards. Crossing some streams that descend to the river Gumchi, he entered the district of Wota and ascended the Bokan, a mountain rising to 8500 feet above sea-level, from which he enjoyed an extensive view. Thence the main chain turns eastwards towards the Omo, and runs along the river southwards, rising in cliffs more than 3300 feet high about six miles from the bank. On the parallel of 6° it turns back westwards, and after keeping this direction for about a degree of longitude again turns towards the south, and expands into the rocky plateau on the north-west of Lake Rudolf. To the east were seen two large elevations standing on the other side of the Omo. One of these, pyramidal in form, with a sharp summit, was the mountain Dime, named by Donaldson Smith, Mount Smith. The other resembled a truncated sugarloaf. Dime stands, according to M. Bulatovich's observations, a few minutes south of the position given by Donaldson Smith.

The southern slope of the range is inhabited by the Gimira. They occupy the valleys of streams that run south-west and flow into the river Mena. The average elevation of the country is 5900 to 6500 feet. The climate is moister than that of Kaffa, the vegetation luxuriant, and the soil productive. The Gimira are of Ethiopian race modified by intermarriage with the neighbouring Negro tribes. They are less warlike than the men of Kaffa, are industrious, and lead the settled life of agriculturists. On February 4th, the traveller in company of a military expedition sent out by Ras Walde Giorgis passed into the territory of the Shura (a Kaffa word meaning "black"). They occupy that part of the main range that runs from north to south parallel to the Omo. Their country is very fruitful, and the climate, less moist than that of Kaffa, is very healthy. The Shura are probably of Negro race and akin to the Shilluk of the Nile. They are in a low stage of civilisation, being ignorant of weaving and cultivating their land in a more primitive fashion than their northern neighbours. Ras Walde tried to induce them to acknowledge the supremacy of Abyssinia, but they gathered their fine herds together and fled into the recesses of the mountains.

On again ascending to the main range, M. Bulatovitch came upon an interesting people of a type more approaching to that of the Galla and Gimira than of the Shura. They occupy that part of the range which runs from the Omo westwards. Their language sounds like that of the Gimira, but the two peoples cannot understand one another, and the roots are generally different. Their lands stretch along the crest of the range continuously, except where there is a march between neighbouring tribes. The fields are carefully cultivated, and the excess of corn above the local demand is exchanged for cattle from the neighbouring peoples. After staying some time in this Beru country, where the Ras built a fort, the journey was continued to the river Kori, which was followed southwards to Benemanie, a place inhabited by Negro tribes, where the site of Bottego's camp was found in 6° 4·8′ N. lat. The valley of the Kori is very low, lying at most 2000 feet above sea-level, and is marked by a hot climate. Hunters wander over it, but it is not inhabited permanently. The river is deep, and some 60 paces broad, with a current of four miles an hour. It swarms with crocodiles.

Leaving the river, which runs northwards, M. Bulatoviteh turned southwards to the Menu mountains, inhabited by Negro tribes probably akin to the Shura. Beyond them, according to their report, are impenetrable forests and waterless deserts, where no one lives. Intending to make straight for Lake Rudolf, the expedition entered a stony plateau where water was found only in pools in the dry beds of streams. The ground was bestrewn with stones, chiefly granite, and the vegetation was short grass with a few trees. No inhabitants were seen, but game was plentiful and varied. Owing to want of water, the expedition was obliged to turn northwards along the Kibisha, a tributary of the Omo. The plateau stands 4600 feet above sea-level. In crossing the plateau a mountain of singular form served as a landmark. It was in shape like a truncated pyramid with another pyramid of smaller dimensions set upon it. It reminded the Russian traveller of the imperial mound at Krasnoe Selo, when the pavilion is set up on it on parade days, and therefore he called it Tsarski Valik (Imperial Mound). The rest of the journey was in country already traversed, down the Omo to Lake Rudolf and along the north-western shore of the lake, beside which the Abyssinian flag was hoisted.—*Izvestiya* of the Russ. Geogr. Soc., tom xxxv. No. 3.

The range of mountains along which the journey was made is that which, in its northern part, was named Shara by Cecchi. It must also have been seen from the Omo by Bottego, who proved the identity of Borelli's Omo with the Nianam of Von Höhnel, and crossed the range near its south-western extremity, calling this

part the Korma mountains and giving the name of Monte Aguzzo to the Tsarski Valik of Bulatovich. This traveller has, according to the *Bull. della Soc. de Geogr. Italiana*, vol. xii. No. 10, given to the range the name of the Emperor Nicholas II. Its existence was known even before Cecchi caught sight of it, but no traveller has named the range as a whole, or traversed its whole length. Nevertheless, it is not to be wondered at that the Italians resent this intrusion of a foreign name on the sphere of their noted explorers.

AMERICA.

Mt. Wrangell.—Two gold-prospectors succeeded in May last in closely approaching this volcano. They had passed the winter on the Copper river, sixty miles from Mt. Wrangell, and in April they started with five or six companions to explore the vicinity of the mountain in hopes of finding gold or copper. From the river Kotsina they ascended the mountain of the same name, and along its offshoots, which join those of Mt. Wrangell, marched close up to the latter. They saw the volcanic cone rising in front of them like a gigantic sugar-loaf. A circular crater half a mile in diameter was vomiting forth dense clouds of black smoke, but no ashes or flame was visible. Some distance below the crater thirteen geysers shoot up solid matter and hot water to a height of 300 or 400 feet at regular intervals. There is not a trace of vegetation on the cone. A thick mantle of snow and ice, flows of lava, constantly covered up again by fresh snow, and rocks which no doubt are masses of cooled lava, cover the surface. The summit appears to be inaccessible. The river Kotsina rises in a valley at the foot of Mt. Wrangell. Copper and gold were found in abundance in the upper basin of this river.—*A travers le Monde*, No. 42.

Navigation of the Rivers of the Chaco.—In the *Boletin del Instituto Geogr. Argentino*, Tomo xx. Nums. 1-6, are accounts of two voyages lately made in boats along the rivers Bermejo and Pilcomayo. Among the most enterprising of the chiefs of industry in the province of Jujuy are the Messrs. Leach, who have introduced new industries and methods of production and working up of materials, and have been energetic in the construction of roads and improving generally the means of communication. They had long cherished the idea of navigating the rivers San Francisco and Bermejo, having heard that the condition of the rivers had been considerably altered.

The Government showed great interest in the undertaking, placed at the disposal of the Messrs. Leach all the information they possessed about the region to be traversed, and supplied them with three boats specially built for their use. To these the Messrs. Leach added two more built at their own establishments. One of these, the *Esperanza*, was drawn through the forest from the factory where it was built, and after great labour was set afloat in the Rio San Pedro. After a voyage of sixteen leagues past the rivers Negro, Ledesma, and San Lorenzo it entered the Sora, where the Government boats and the *Bertha* built at the Messrs. Leach's coffee plantation awaited it.

On the 13th March the boats started on their voyage under the command of Messrs. Walter and Stephen Leach, and with the author of the narrative, Sr. F. W. Clunie, on board. During the first seventeen days the crews had hard work in dragging and pushing the boats, and getting them afloat when they ran aground, and were much inconvenienced by rain and stormy weather. There was abundance of water for the boats, the largest of which did not draw more than twenty inches, but it ran in many different channels, in one or other of which there was

always sufficient depth for a certain distance and then shallows had to be crossed. The current also was strong, running at the rate of four to four and a half miles an hour, and sometimes carried with it trunks of trees. On March 21st the expedition emerged from the Rio San Francisco, which is really part of the Rio Grande de Jujuy, into the Bermejo ; the position of the confluence is 23° 18′ 40″ S. lat. and 64° 5′ 57″ W. long. Passing Luna Muerta and the Villa Carmen district, they came in lat. 23° 28′ 2″ and long. 63° 17′ to the point where the Rio Teuco branches off from the Bermejo, which here ceases to carry water. In the Teuco, as in the former part of the journey, the boats were violently agitated by huge waves which suddenly rose to heights of three to twelve feet, sweeping everything before them, and disappeared at a distance of a hundred yards, leaving the surface of the water quite smooth. Some explain their formation by the action of the wind when blowing against the current in those places where the bed of the river is escarped, while others attribute them to moving sands at the bottom. But Sr. Clunie found that the phenomenon occurred where the bed was flat as well as where it was escarped, in deep water and shallow, and considers them to be of the nature of tidal waves.

On the Teuco the expedition fell in with some Mataco Indians, one of whom complained that they were being ejected by advancing civilisation from the lands which they had owned, and thrust more and more towards the territory of their hereditary enemies, the Tobas. Then a district abounding in jaguars was passed, to which the name Region de los Tigres was given, where also mosquitoes were exceedingly troublesome, and the confluence of the Teuco with the Bermejo was reached in lat. 25° 36′ 50″ and long. 60° 14′ 27″. The length of the Teuco is 240 miles. Henceforth the voyage was monotonous, the boats being rowed continuously for eight hours a day. On April 16th the expedition reached the Paraguay river, 146 miles from the mouth of the Teuco, and passing the night at Porto Bermejo descended to Corrientes.

The scenery in the provinces of Salta and Jujuy is magnificent, the crests of the mountains of Santa Barbara and Calilegua forming the background, and the woods are fine. Along the Bermejo the country is less pleasing, for the Chaco is flat, swampy, and dreary. Where there are woods they are composed of young trees. Below the Teuco the flora improves both in quality and variety, but the trees are small and not likely to have any commercial value. Aquatic birds are very numerous, and an ornithologist might make a good collection. Wild pigs and carpinchos are abundant, and the water swarms with fish. Caimans were not seen.

The possibility of navigating the Bermejo and its feeders up to the province of Jujuy has been proved beyond doubt. The difficulties can easily be overcome by engineers.

On May 8th, 1898, the engineer Enrique Ibarreta, with ten companions, left Tarija in Bolivia with the intention of navigating the Pilcomayo down to the Paraguay. On December 21st two of the party arrived at Asuncion and gave an account of their experiences. The expedition left the San Antonio mission on June 3rd in two flat-bottomed boats, and came in contact with the Indians after passing Fort Crevaux. These were not openly hostile, being appeased by two friendly Indians who accompanied Sr. Ibarreta, but their attitude was very threatening. At a short distance from the San Francisco mission the Pilcomayo runs between high banks, and the current is strong. The direction is in general very straight ; the depth and breadth vary considerably. Two swamps were passed with great labour, the crews of the boats standing up to their waists cutting away the reeds. Then the party came to rapids, one of which, named El Chorro, had a fall of eight feet. Sr. Ibarreta carried his boats down on a slide made with

branches of trees. The rapids are situated in 23° 30′ S. lat., and were reached in 1882 from the mouth of the river by the Argentine explorer, Luis Jorge Fontana. On arriving at the swamps of Patiño, where the operation of cutting away the reeds had to be repeated, Sr. Ibarreta sent out his companions to search for Indians and obtain provisions, as the supply brought from Bolivia was exhausted. No Indians were found, and as there was not enough game to support the party, Sr. Ibarreta despatched eight of them to obtain assistance from the Governor of Formosa, refusing to abandon his boats. Of these only two succeeded in reaching Asuncion.

D. Jose Montero was sent by the Argentine Government in search of Sr. Ibarreta and his two companions. He ascended the Pilcomayo in the steam launch *Riachuelo*, making inquiries on the way from the Toba chief, Manuel. On arriving at the bifurcation of the river he chose the southern branch, which was explored by Valentin Feilberg in 1884 (Captain Page, with whom Mr. Graham Kerr ascended the river, followed the northern branch). During the first six weeks of the present year the party struggled up this branch, running into stumps of trees and cutting a way through the branches, which often met across the stream, until at length the *Riachuelo*, which drew three feet of water, could proceed no further. Then D. Montero continued his journey in a small boat, passing a series of rapids and arriving at a reedy swamp where the water was too shallow even for the boat. He was therefore obliged to return, convinced that the lost explorer could be reached only by a mounted party. On his way down the Pilcomayo he obtained from Manuel and other Indians certain proofs that Ibarreta and his companions had been murdered by Pilaga Indians, and his boats plundered.

Dr. Hans Steffen on the Baker Canal.—On p. 489 it was reported that Dr. F. P. Moreno had claimed priority of discovery in this region. There could be no doubt that if Dr. Steffen had known of these discoveries he would have given to the Argentine explorers whatever share of credit they deserved. In *El Ferrocarril* of Sept. 13th, a copy of which has been forwarded by Dr. Steffen, he states that the name Baker Canal was not given by him but by the officers of the Chilian vessel *Toro*, who made the first detailed exploration of the inlet in 1888. "Estero Messier," the name given it by Josef Garcia is not admissible, because it denotes the strait between the continent and the archipelagoes lying off the coast between Tarn bay and the Angostura Inglesa, and if Sr. Serrano Montaner in his *Derrotero del Estrecho de Magellanes* introduced the name Estero Calen (which Padre Garcia applied to the present Canal Messier), it must have been because he ignored the name given already by the officers of the *Toro*.

Dr. Steffen grants that Señor Moreno visited the Canal Baker in 1897, whereas he himself did not start on his expedition till late in 1898. All the information, however, that he could obtain from the Boundary Bureau was that an Argentine commission had discovered a river draining the Lago de Buenos Aires, to which the name Rio de las Heras had been given, and which was believed to flow in the direction of the Baker Canal.

The Lago Cochrane, which name Dr. Moreno wishes to change to Lago Pueyrredon, was superficially explored at its eastern extremity in 1897-98 independently by Chilian and Argentine sub-commissions, and the name Cochrane, as also that of the Baker Canal, appears in the minutes of the conference of the reports of August 29th, 1898, unaccompanied by any protest on the part of the Argentine expert.

Dr. Steffen suggested that his Rio de la Pascua might be the Rio Mayer of Hatcher (p. 322); while Dr. Moreno states that the Rio Mayer runs into the lake

San Martin, and the Rio Pascua (or Toro) drains it. This seems not to have been proved, for Dr. Steffen found at the mouth of the river a paper in a bottle, on which it was stated that the Argentine explorers had navigated the river, "which appears to issue from a lagoon in a north-easterly direction." Dr. Steffen ascended the valley and from a hill saw that the main stream did not proceed from the lagoon, but from a defile on the south, the upper section losing itself to the south-east in lofty snow-covered mountains. The Rio Mayer was traced by Mr. Hatcher to a point in lat. 48° 30′, towards which the Valley of the Rio de la Pascua appeared to run.

With regard to the Rio Baker, Dr. Steffen cannot speak so positively as he has seen no map of the Argentine explorations except one in a supplement to the *Argentinisches Tage- und Wochenblatt*, which is not official. It is full of mistakes, and shows the mouth of the Rio de las Heras as situated in the northern corner of the great northern arm of the Baker Canal, where there are really two rivers, the larger descending from a glacier to the north-west and the other, quite insignificant, issuing from a narrow defile on the north-east. The Rio Baker, far larger than either, enters the canal some dozen miles more to the south-east behind a series of high-wooded islands. Dr. Steffen passed several times along the banks of the lower part of the river, but never found any traces of previous explorers. In the map referred to the Lago Buenos Aires is drained by a Rio San Benito, which enters a fiord on the coast occupying the position of Kelly Harbour on the British Admiralty charts, while the Rio de las Heras rises on the large plateau south of the lake and traverses the Lago Soler.[1] All the small rivers entering the eastern extremity of Kelly Harbour were found by Dr. Steffen to proceed from a huge glacier on the east and south-east. The problem of the drainage of the Lago Buenos Aires has still to be solved.

Dr. Moreno maintains that the Rio de las Heras is not a Chilian river through its whole course, because it cuts the cordillera, whereas Dr. Steffen affirms that, if it is identical with the Rio Baker, the part of its valley explored by him, with its eastern affluents and the Lago Cochrane, the Rio del Salto, Rio de los Ñadis and others which descend from the enormous mass of Mt. Cochrane, lie within the region of the cordillera and on the western slope of the watershed.

MISCELLANEOUS.

The arrival of the **Foureau-Lamy** expedition at Lake Chad is reported. Foureau has traversed the route through Aïr for the first time since Richardson and Barth travelled along it in 1850.

The **Sierra Leone railway** has been constructed from Freetown to Songo, a distance of 32 miles, and preparatory work has been executed along the route for 80 miles farther, so that before long 112 miles will be open.

Mr. Mackinder's expedition to **Mt. Kenia** has been successful. The summit was reached on the third attempt and found to be over 17,000 feet in altitude. Fifteen glaciers were discovered, two of them of large size.—*Geogr. Journ.*, Nov.

Mr. W. G. Black, F.R.C.S.E., has in the press a work by his uncle, William Black, L.R.C.S.E., Surgeon H.M.S. *Chanticleer*, entitled *Narrative of Cruises in the Mediterranean during the Greek War of Independence* 1822-1826. Official visits to various ports are described, and scenes of operations of war before the naval

[1] The topography, according to Dr. Moreno's views, is correctly shown in a map in the *Geographical Journal* for September.

battle of Navarino in the Morea. It will be published immediately by Messrs. Oliver and Boyd, Edinburgh.

Since March last the Belgians have been engaged in the construction of a line of railway which is intended to open up the country between the **Lower Congo**, the Portuguese Territory of Cabinda and the French Congo. The track runs from Boma in a northerly direction, gradually diverging towards the west, and terminates at Buku Dungu on the Shiloango river. The length of the railway will be about 125 miles.—*Globus*, Bd. lxxvi. No. 18.

The International Glacier Commission has lately examined the **Unteraar glacier** and measured the movement of the fragments of the great mass of rock known as the Hôtel des Neuchâtelois, which first attracted attention in 1834. According to the measurements of Louis Agassiz it moved 240 feet a year from 1842 to 1846. From 1846 to 1884 the movement was 180 feet a year and 174 from 1884 to 1899. —*Verh. der Gesell. für Erdkunde zu Berlin*, No. 7.

The great road from Resht on the **Caspian Sea to Teheran**, commenced by the Russian Government three years ago, is now completed. It is 217 miles long and great technical difficulties have had to be overcome. The control of the road is in the hands of the Persian Government, which has erected nine barriers along the route, where very heavy tolls are levied. The Russian officials are only allowed to see that the road and the telegraph along it are kept in proper repair. It is said that the Russians will continue the road to Ispahan.—*Geogr. Zeitschrift*, Jahrg. v. Heft 10.

Dr. J. Cornet has published a detailed account of the **geology of the Lower Congo** in the *Bulletin de la Soc. Belge de Géologie*, tome xi., entitled "Études sur la Geologie du Congo Occidental entre la Côte et le Confluent du Ruki." He finds that the succession of rocks between the ocean and Stanley Pool fixed in 1882 by Pechuel-Loesche, is quite correct. He distinguishes (1) a maritime zone of Secondary, Tertiary, and more recent deposits; (2) a crystalline zone of Primary metamorphic rocks; (3) a zone of calcareous schists, perhaps Devonian; and (4) a zone of sandstone, probably Secondary.

On July 19th at 8 P.M. the main crater of **Etna** threw out an immense quantity of steam, stones, lapilli, and glowing ashes and covered the southern flank of the mountain down to Zafferana Etnea (2000 feet above sea-level) with volcanic ash. The iron plates of the roof of the observatory, 1100 yards distant, were broken, and fifty holes were counted in the surrounding sandy soil, made by falling stones. The eruption was not accompanied by an earthquake; only at the lower end of the Valle del Bove was a slight shock noticed. The seismometers in the Etna observatory showed horizontal and vertical oscillations.—*Globus*, Bd. lxxvi. No. 16.

The Société de Géographie Commerciale of Paris will take the opportunity afforded by the International Exhibition to hold a **Congress of Economic and Commercial Geography** in Paris from August 27th to the 31st, 1900. The subjects of discussion will be arranged under four sections:—(1) Exploration and Trade Routes, including questions relating to ports, merchant navies, etc.; (2) Natural and Manufactured Products, and their exchange; (3) Emigration and Colonisation, including the labour supply; and (4) Diffusion of Geographical Knowledge, by periodicals, schools, and museums.

Intending visitors to the Congress should give in their names, and pay the fee, to M. Mégemont, Rue de Tournon, 8, Paris. The Secretary, M. Georges Foucart, or M. Marcel Monnier at the same address, will answer inquiries relating to the Congress.

NEW BOOKS.

Secondo Spedizione Bòttego. L'Omo: Viaggio d'Esplorazione nell'Africa Orientale. Narrato da L. Vannutelli e C. Citerni. Sotto gli auspici della Società Geografica Italiana. Con 141 incisioni, 11 tavole e 9 carte. Milano: Ulrico Hoepli, 1899. Pp. xi + 650. *Price* 10 *L.*

The Geographical Notes of this *Magazine* have duly apprised its readers of the chief results obtained by the Second Bòttego Expedition as they appeared in the *Journal* of the Italian Geographical Society, under the auspices of which the expedition was conducted. In this handsome tome the full details are now accessible to all. Owing to the lamented deaths of Captain Vittorio Bòttego and Dr. Maurizio Sacchi, the duty has devolved upon their comrades, Lieutenants Vannutelli and Citerni, to give an account of this journey, and prepare the report of their work for the behoof of the geographical world. They have made it their aim to present the public with a book which shall give without scientific pretensions or pomp of erudition, to cite their own words, a genuine recital of facts, a faithful description of things seen, a simple and plain exposition of actual observations. The narrative consists of twenty chapters, which may be divided into four parts: the first, of four chapters, deals with the journey up to Lugh; the second, of five chapters, from Lugh to Lake Queen Margherita; the third, of five chapters, deals with the Omo and Lake Rudolf; the fourth, of sixth chapters, deals with the basin of the Nile, that is, with the Sobat and several of its tributaries.

In an introduction of eight pages there is a short review of our geographical knowledge from the sixteenth century regarding the Zebe river, which latterly became the Gibbi or Gibbe, the Gojab or Gojeb, and the Omo or Uma, and of the several theories based upon hearsay reports whether this river flowed to the Indian Ocean through the Juba, or into the Nile by way of the Baro and Sobat, or into a lake such as Lake Abbala according to Traversi, or Lake Rudolf according to Teleki, Höhnel, and Borelli. Donaldson Smith, however, had revived the theory that the Omo hydrographic system was connected with the Juba, probably through its tributary, the Daua. Such was the position of the problem when the Bòttego expedition was organised to solve it. Here we may notice that our authors say the name Omo appeared for the first time in 1858 in the writings of Father Léon des Avanchers. No precise reference is given to show which letter or report of that missionary is intended, but certainly Beke, Krapf, Harris, and Abbadie had all heard of the Omo, and reported its locality between 1839 and 1844, while Abbadie had ascertained fifteen years before the above date of Avanchers that the Gibbi, after its junction with the Gojab, became known as the Omo or Uma in the territory of the Woratta.

According to its instructions, the Second Bòttego Expedition was designed to arrive at the Omo from the Benadir coast by way of Lugh and the Upper Juba, to visit Lake Abbala or Lake Abbaya and Mount Wosho, and, after exploring the basin of the Omo, ascertain whether or not, supposing it flowed into Lake Rudolf, it was an emissary of that lake and connected with the Nile. The way of return was to be through the Sobat region, the Yabus and Tumat to Fazokl, and thence to Massaua by way of Kassala.

On the 3rd of July 1895 Bòttego departed from Naples, on the 12th of October from Brava, and arrived at Lugh on the 18th of November. The distance from Brava to Lugh is given in the text as 180 miles, but in one of the appendices it is given as 350 kil.; it occupied the caravan twenty marches, but fifteen days

is spoken of as the time for an ordinary caravan. At Lugh a fort and a commercial depôt were founded. As a commercial centre Lugh is compared to Timbuktu and Harar. Representatives of all the races of East Africa are met with; the dominant race is the Somali, but, while the Somali language is that generally spoken, the Galla language is also in general use, and may be regarded as the commercial language of East Africa. At Lugh a stay was made of a month and a half, and a most interesting reconnaissance was made up the Web, the left bank tributary of the Juba above Lugh, which was ascended up to the parallel 5° 31′ of north latitude, and the markland between the Somali and the Galla was ascertained as represented by the Di-Godia (Donaldson Smith's Dagodi) and the Arussi.

Between Lugh and the Omo the expedition passed through the territory of the Garra, the Boran, the Amar, the Badditu, the Gergedda on the east side of Lake Margherita, the Borodda, and the Gamo on the west. The principal caravan route to the lakes from Lugh is along the Daua. It was the 27th of January that the travellers departed from Lugh; on the 29th they measured the Daua and its volume of water, and were convinced that it could not be the lower course of the Omo. From the junction of the Daua to the Boran country, and even to Lake Abbaya, the results of the Bòttego Expedition can be compared with those of Donaldson Smith; the former, however, followed the left bank of the river for some distance. The Garra (Donaldson Smith's Gere) are divided into Garra-Marra, Garra-Ganana, Garra-Livin, and Garra-Liban. According to Donaldson Smith they are Galla, but according to this book they are Somali. The Garra-Marra speak both Somali and Galla, but Somali alone among themselves; the Garra-Ganana speak Galla, and have evident affinities with the Galla race; the Garra-Livin are Somali and Musalmans, but by language and customs seem to be most connected with the Boran. This ethnographic problem remains unsolved. South of the Daua the Boran territory begins at Sankurar, where it borders on the Garra-Liban. From Cherkale there is a caravan highway to Bardera by way of the wells of El Wak. A chapter each is given to the Boran, the Amar, and the Badditu, and to a detailed account of Lake Margherita. In this latter region the Italian travellers have supplemented Donaldson Smith's account, whose Lake Abbaya is here named Lake Chamo, and is connected with Lake Margherita by the river Walo. Thus, with a visit to Lake Stefanie, this hydrographic system of the river Sagan has been fully explored. When at Lake Margherita the travellers heard of a chain of lakes to the north, and if they had followed this clue they would have solved the entire problem of the hydrographic system, which has now been settled by M. Darragon and Captain Wellby; but the presence of the Abyssinians rendered it prudent to keep to the main aim of the expedition.

It was in the middle of June 1896 that they arrived at the divide which forms the watersheds of the Omo and the Sagan. When on the west side of Queen Margherita Lake it would have been in accordance with the instructions given to the expedition to make for Mount Wosho and the Walamo or Walaita territory, and to arrive at the Omo by way of the Deme. Borelli had laid down the course of the Omo to the east of Mount Bobbe in Kullo, which is opposite Mount Wosho, and thus the Bòttego Expedition might have linked up their work with that of Borelli without leaving any gap. The Abyssinians, however, were already in effective occupation of the Walamo territory, and, in order to avoid them, Bottego passed into the basin of the Omo by way of the Maze and the territory of Kucha and Gofa. On the 29th of June he arrived at the Omo.

The river was there, in Gofa a little below the junction of the Maze, 150 m. wide, flowing between Walamo, Kucha, and Gofa on the left bank, and Kullo,

Kontab, and Koisha on the right. From that point the expedition followed the Omo down to Lake Rudolf, and explored the west side of the lake in order to make sure that there was no emissary connecting it with the hydrographic system of the Nile. To indicate the spirit of veridical accuracy which characterises both narrative and maps it will suffice to say that where the channel of the Omo was not actually followed and observed the gap is carefully marked on the map. Such a gap there is between Borelli's southern point and the northern point of Bòttego, and another gap occurs in the territory of the Malo to the west of Gofa, but these gaps can in no way derogate from the claim and the honour of the Second Bòttego Expedition to have solved the problem of the Omo. We say this, having in mind a rather unbecoming claim made recently by the Russian traveller Bulatovich, who visited the Omo under the wing of an Abyssinian general.

The problem of the Omo, however, was not the whole of the work which Bòttego achieved. On the last day of December 1896 he passed into the basin of the Nile, striking one of the head streams of the Juba. On the 3rd of January he arrived at the main stream, and followed it to the swamp-land above its junction with the Sobat. Retracing his steps, and then proceeding north, he arrived at the Sobat on the 26th of February. From this point he followed the right bank of the Sobat up to its right bank tributary, the Sakko, a little above Gambela. Quitting the Sobat on the 3rd of March, he ascended the healthy upland of Sayo, and arrived at Yellem, near Gobo in Lega, on the 16th of March. From Lugh to Lega the Amhara had been in fact, as well as in thought, unwelcome neighbours, and now occurred the tragic death of Captain Bòttego when, having linked up his work with that of Schuver, he had fulfilled his mission.

From this bald outline it will be seen that this book deals with a part of north-east Africa which is at this moment of great importance, when the territories of Britain, Egypt, and Abyssinia have to be delimited. The accounts of the Boran and of Lega are especially worthy of notice, but we can do no more here than commend them. It behoves us to add that the narrative, based on the notes of the diary, is written in a straightforward and interesting style, which often becomes vivid with a touch of feeling that rivals romance.

At the end of the work an account is given of the Tertale table-land, between Lake Stefanie and Ashebo (Ascebo) in the Boran territory, with a special map, derived from the notes of Dr. Maurizio Sacchi, who lost his life on the 7th of February 1897, after having done admirable work from the Juba to the Omo and Lake Rudolf. The map is on the scale of 1 : 500,000.

There are five appendices, in which the meteorological and astronomical observations, as well as the geological and zoological collections, are discussed by specialists, with a good geological map of the country from the Juba to the Omo, on the scale of 1 : 3,000,000.

The illustrations are excellent, and an efficient aid to our geographical and ethnographical knowledge. Seven maps, in addition to the two already mentioned, are devoted to the illustration of the itinerary, five of them on a scale of 1 : 1,000,000 ; one, a special map of Queen Margherita Lake, on 1 : 500,000 ; and a general map of the whole region on a scale of 1 : 3,000,000. These have been most carefully constructed, and are likewise most admirable cartographic work.

The volume is introduced by the Marquess Giacomo Doria, as President of the Italian Geographical Society. The Society is to be congratulated not only on the work which the expedition achieved, but on the handsome way in which its results are here made accessible to the whole geographical world. The authors have

dedicated the book in the following words :—"A te che amato e pianto qui revivi." Sympathy with the Bòttego family and with the Geographical Society of Italy blends with admiration as we think of the martyr to science whose name and fame are here commemorated.

The Expansion of Egypt under Anglo-Egyptian Condominium. By Arthur Silva White. London : Methuen and Co., 1899. Pp. 483. *Price* 15*s. net.*

Although this work has appeared at a time when men's minds are occupied with the problems of Southern, rather than Northern, Africa, we must remember that the Egyptian question, although presently quiescent, is not yet permanently settled. Mr. White's contribution to its settlement is largely the result of his observation of Egyptian affairs during the two winters (1896-98) which he spent in Egypt. He remarks :—"Since physical factors influence or determine political issues and results, I have based my inquiry on the principles of geography. Since the Nile valley is under the domination of Great Britain, I have been constrained to examine the genesis, and to outline the course, of British imperial policy in order to identify its aims with the development and expansion of Egypt." He gives an abstract of the present volume as follows :—"From an examination of physical factors (Part I.) I derive the organic unity of the Nile valley. In Parts II. to IV. inclusive, I produce the internal and external factors which, in their cumulative effect, point to its political unity under the Power holding command of the sea and already exercising a *de facto* protectorate. The political situation in Egypt (Part V.) demonstrates the instability of Egyptian institutions ; and an elaborate survey of the Anglo-Egyptian administration (Part VI.), dealing with the departments of State, illustrates the extent to which these depend on British control and initiative. International interests are shown to predominate and centre in the Suez Canal (Part VII.). And in Part VIII. I have sought the most natural solution of the Egyptian problem. That the solution which I advocate is inevitable may be gathered from the concluding Parts of my work (IX. and X.). In or before the year 1905 a British protectorate, or its equivalent, must, in my opinion, be proclaimed throughout the valley of the Nile."

As Britain will shortly have to undertake the permanent reorganisation of South Africa under the supremacy of the Queen, the British Government's hands will probably for years be too full to allow it radically to reorganise Egypt. In all likelihood it will follow the advice given by Lord Cromer in his Report for 1898, quoted by Mr. White (p. 353) :—"For the present, what Egypt most requires, and for many years to come will require, is an honest, just, and orderly administration, and the establishment of the supremacy of the law, in the widest sense of the term, on so firm a footing as to render practically impossible any return to that personal system of government which twenty years ago was wellnigh the ruin of the country, as it has been that of so many Oriental states. It is conceivable that, at some future time, the Egyptian question may pass from the administrative into the political stage, and that a moment will arrive when the method of government may be discussed with advantage to all the interests, whether foreign or native, which are concerned. For the present, however, that moment would appear to be distant."

As a solid contribution to a difficult question this volume will take a high place in the now extensive bibliography of modern Egypt. It is illustrated by admirable maps of north-east Africa, showing its orographical features, climatological data, zones of vegetation, and political boundaries and data. The book abounds in instructive statistics compiled with great industry by Mr. White. Thus, he shows that in Egyptian schools, whilst in 1889 only 26 per cent. of the children

learned English and 74 per cent. French, 67 per cent. learned English and only 33 per cent. French in 1898.

Du Dahomé au Sahara. By Commandant Toutée. Paris : Armand Colin et Cie., 1899. With Map and several Diagrams. Pp. xii + 272. *Price Fr.* 3.50.

The narrative description of Commandant Toutée's mission to the Dahomey *Hinterland* and to the Middle Niger in the years 1894-1895 was duly noticed in a previous volume of this magazine.[1] That account is now supplemented by the work under consideration, which deals with the physical conditions of the territory traversed by the writer and his party, and with the manners, customs, and ethnological position of its inhabitants; concluding with a chapter on the "Hygiene of the Whites in the Region." In his dedicatory preface the author points out that if he partly failed in carrying out all the purposes of his expedition, he, at any rate, succeeded completely in that part of his programme which had in view the precise ascertaining of the course of the Middle Niger, with regard to which there had previously been much uncertainty. He was less fortunate in his scientific work, apart from geography; for nearly all his valuable collection of geological, botanical, and zoological specimens was unhappily lost in the wreck of the vessel that carried his officers down the Lower Niger on their return journey. It is partly on account of this mishap, therefore, that his latest book appeals more to the general reader than to the specialist.

The first three chapters are devoted to a description of the soil and its products, and of the animals, both domestic and wild, of that region. Of these last none is more troublesome than the tiny chigoes and mosquitoes. The chigoe, better known in the British West Indies and the United States by its anglicised form, "jigger," is characterised by Captain Toutée as having "the dimensions and the manners of the itch-mite." "The chigoe usually instals herself beneath the skin without being suspected, and there she deposits her young ones. At the end of twenty-four hours a small subcutaneous tumour appears, of the size of a pea, of a whitish colour, which is nothing else than an enormous number of little chigoes bunched together. All that is needed is to remove this apparent tumour and to wash with a disinfectant the slight wound thereby caused. Nevertheless, the skin is also removed, leaving a deep hole in the quick flesh. This causes a trifling sore which takes some time to heal. But when, as frequently happens, the soldiers have been on night service, and have thus been prevented from taking off their boots, and the chigoe has consequently been left undisturbed for forty-eight hours, its ravages assume alarming proportions. A little ball of flesh as big as a hazel-nut comes off, and a wound larger than a twenty-sous piece remains, necessitating the most careful treatment."

Of the other aggressive insect pests, the mosquitoes, Captain Toutée has some remarks to make bearing upon the current question as to their power of infecting man with the germs of malaria. "Many able men," he says, "are inclined to believe that the mosquito inoculates people with the virus of malarial fever by means of his sting. Speaking for myself, I can certainly say that I never had fever until five months after leaving the coast for the interior, that during that time I only drank water that had been boiled and so rendered innocuous, and that I did not fall ill until after the attacks of the mosquitoes had assumed the proportions just indicated"—referring to a certain night of torment which left traces of two hundred bites discernible on his person on the following morning. "Therefore," he con-

[1] *Dahomé, Niger, Touareg*: reviewed vol. xiii. p. 387.

cludes, "I accuse the mosquito of being in part the propagator of malarial fever. The presence of an antiseptic agent, formic acid, in the poison peculiar to the mosquito does not seem to me a reason sufficiently strong to overwhelm the arguments incriminating the insect."

Captain Toutée furnishes a graphic survey of the various races inhabiting that portion of the Western Soudan. Of diverse origin, they appear to be much blended at the present day; but it is interesting to note that pre-eminently the ruling caste is that of the white-skinned Berber race of the Tuaregs, who determinedly maintain their position as an aristocracy over the inferior indigenous tribes. "Not only are the Tuaregs as a people regarded as the suzerain power, but each individual Tuareg considers himself and is considered as the lord and master of every black that he comes in contact with. The spirit of domination has introduced or developed among the Tuaregs a profoundly aristocratic habit of life. It is not alone that they never appear before their subjects except on horseback and well mounted, armed to the teeth, and followed by servants, but they, moreover, constantly and successfully seek to declare their superiority by the dignity of their attitude and by the energy of their slightest actions. In short, this Tuareg society, sole representative of the white race amidst negro barbarism, proclaims itself to be an aristocracy, holding its own by violent means undoubtedly, but an aristocracy nevertheless."

Five chapters, or more than half the book, deal with the social and racial characteristics of those different peoples, and one gains therefrom an excellent idea of native life in that desert region of Western Africa.

China. By Professor R. K. Douglas. ("The Story of the Nations Series.") London: T. Fisher Unwin, 1899. Pp. xix + 456. *Price* 5*s.*

This forms the fiftieth volume of the well-known series of historic manuals published by Unwin. In general appearance it resembles its predecessors, the interest of the letterpress being enhanced by nearly fifty illustrations bearing on the scenery, life, and history of this oldest of old-world empires. Only the salient points of a continuous history extending over 2500 years could, of course, be touched upon; and it must have been no small task for Professor Douglas to decide on what to keep in and what to leave out. The very early and mythical eras are passed over with commendable brevity, the author apparently giving his adhesion to the theory of the common origin of the Akkadians and Chinese. That, no doubt, is largely in the clouds; but, like most speculations of the sort, it has a peculiar fascination for the mind. The extraordinary influence of Confucius, the rise of the Manchu power, and the long and essentially prosperous reign of Ch'ienlung, receive special attention; and then begins what might be called the modern history of China, with all its strange variety of warlike incident. From the days of Lord Macartney's mission of 1792 to the present year there has been an endless struggle between Europe and China; and very suggestive is the fact that the struggle still continues. The exciting episodes of the last fifty years can never pall in interest; and Professor Douglas gives many a vivid picture of these stirring times. The horrible experiences of Sir Harry Parkes and Sir Henry Loch, their imprisonment and all-but execution, the T'aip'ing Rebellion and General Gordon's exploits, read more like romance than history; and through it all runs the more or less incomprehensible influence of Li Hung Chang, the most inscrutable of modern diplomatists. The last chapter gives an account of the leading events of the war between China and Japan, the Russian aggression on the north, and the general scramble on the part of other European Powers for spheres of influence. The great commercial interests of our country in the Far East, and the certainty that these will grow with the coming

century, surely make it imperative that all of us should have at least a general knowledge of the history of our intercourse with China. For this purpose Professor Douglas's book is admirably adapted ; and its perusal will not only give the reader a comprehensive view of the situation in Chinese lands and their neighbouring territories and seas, but will enable him to follow intelligently the ever developing course of events.

Chasses aux Grands Fauves pendant la traversée du Continent noir du Zambèze au Congo Français. Par EDOUARD FOA. Paris : Plon, 1899. Pp. 352. *Price* 10 *francs.*

This handsome volume will take a leading place in the library of Big Game shooting. It is by a past master in the sport, one who has "crossed Equatorial Africa on foot, with his rifle on his shoulder, from the Indian to the Atlantic Ocean, during the years 1894-98." How M. Foa travelled during rain is interesting reading. "When it rained during my shooting or other excursions in the bush, I was accustomed to strip naked, placing my breeches and coat in a little waterproof bag, and having, like the blacks, a girdle round my loins. Only my cap and boots remained upon me. I daresay I did not, thus attired, have a very elegant appearance, but I discovered that during rain nothing could be more sensible. As soon as the rain stopped, my skin dried, and I had not the disagreeable sensation of wet clothes, and I avoided taking fever or rheumatism. Whenever the weather improved I put on my dry clothes again. It is because the blacks go naked in the rains that they do not become ill, for a man's skin is the best waterproof he will ever get. As for shrubs and thorns, they chiefly scratch one's legs and arms, and I am accustomed to that. I should have liked to have walked barefoot like the blacks, it is such an enormous advantage when out shooting, but unfortunately I found it impossible. Hardness of foot is only acquired by walking barefoot from childhood. I have often tried it, but had always to give it up."

The book is beautifully printed and illustrated, and contains a map of Equatorial Africa, showing M. Foa's route when he crossed it, and also the routes of his various travels in Africa.

Chambers's Commercial Handbooks.—*Commercial Geography of the British Isles.* By A. J. HERBERTSON, Ph.D., F.R.G.S., etc. W. and R. Chambers, Ltd. 1899.

The highest praise must be given to this excellent little text-book. Dr. A. J. Herbertson has undoubtedly treated his subject in a most masterly manner, and with thoroughly scientific spirit. The student, as well as the teacher, joyfully misses lists of names and facts to be learnt by heart ; is encouraged to think out the subject for himself, and to see that economic geography is of living interest, being built up day by day with the progress of the world. The biologist will regret to see such terms as "shell fish" (p. 35) encouraged, and to see lobsters and oysters classed as "fish" (p. 85). But these are minor details which will probably be remedied in future editions.

Anthropogeographie. Erster Teil. *Grundzüge der Anwendung der Erdkunde auf die Geschichte.* Von Dr. FRIEDRICH RATZEL, Professor der Geographie an der Universität, Leipzig. Zweite Auflage. Stuttgart : J. Engelhorn, 1899. Pp. xviii + 604.

Many alterations have been made in this new edition. Since 1882, when the work first appeared, Professor Ratzel has made many contributions to geographical

literature, and the study of the world in relation to man has made considerable progress. In the present edition much of the political geography has been omitted, the author having treated that subject in a separate work, which was reviewed in vol. xiv. p. 500. Among the additions perhaps the most important is a long section on migrations, while many of the subdivisions of the subject have been discussed with greater detail and definiteness. The book is indispensable to all students of the higher geography, and those who already possess the first edition will do well to read the new one.

Schattenplastik und Farbenplastik. Beiträge zur Geschichte und Theorie der Geländedarstellung. Von Dr. Karl Peucker. Wien: Artaria and Co., 1898.

In his introduction Dr. Peuker informs us that this interesting study was intended originally to serve as a commentary on the collection of maps exhibited by Messrs. Artaria and Co. at the Jubilee Exhibition of 1898 in Vienna. He has, however, expanded it into a critical appreciation of the labours of the eminent Austrian cartographer, Franz Ritter von Hauslab, who was born in 1798 and died in 1883, as Inspector-General of Ordnance, at the advanced age of eighty-five, after having devoted a large part of his life to improving the means of producing hypsometrical and relief maps by scientific shading and colouring. The first to make use of isohyps or contour-lines is said to have been Ducarla, a Genevan engineer, who in 1791, in conjunction with Dupain Triel, produced a hypsometrical map of France. Hauslab was, however, the first to project a hypsometrical map with a definite and systematic colour-scale, and, along with Anton Steinhauser, the first to draw and publish school-maps according to this system. His fundamental principle—the higher, the darker—in showing the heights of the land, has been almost universally adopted on the survey maps of all countries, as well as by private map-makers. Excellent portraits of Hauslab and Steinhauser are given, and the book will repay perusal by all who are interested in the production of maps and the scientific methods by which the best results are attainable.

The Wealth and Progress of New South Wales, 1897-98. By T. A. Coghlan, Government Statistician. Sydney: W. A. Gullick, 1899. Pp. 1084.

The plan of this issue is exactly the same as that of the previous one, reviewed in vol. xiv. p. 501. The work of compiling must, however, have been very considerable, as each year brings new statistics. The trade of the colony in 1897-98 was greater than in any previous year, the area of land alienated by the Government was larger than in the preceding year, though naturally not so large as when there was more unoccupied land near the coast and towns, and in general the colony is progressing.

The Guide to South Africa. Edited annually by A. Samler Brown and G. Gordon Brown. London: Sampson Low, 1899. Pp. xlviii + 420. *Price* 2*s.* 6*d.*

Though tourists, invalids, and settlers are not likely to flock to the Cape at the present moment, the new edition of the guide will not want readers, as it contains a large amount of information which will interest readers at home. The additions are small, the revision consisting for the most part of new statistics, etc.

Geografia Comercial de la America del Sur. Por Carlos B. Cisneros y Romulo E. Garcia. Entregas 1, 2 y 3. Lima: Imprenta y Librería de San Pedro, 1897. Pp. 232.

These numbers contain a few pages on South America as a whole, followed by accounts of the Argentine Republic and Bolivia. The Argentine Republic is the most advanced of the South American States, and its products are numerous and abundant. We have here full details, accompanied by statistics, on cattle-grazing and dairy products, wine, sugar, corn, tobacco, minerals, chemicals, timber, etc., as well as on the state of the finances, foreign trade, education, custom duties, etc. In conclusion a paragraph is devoted to each of the provinces and territories. These paragraphs might with advantage have been a little longer; for instance, no mention is made of the sheep-feeding which is being rapidly developed in Tierra Fuego. Somewhat more might also have been said on the means of transport, especially with regard to the limits of navigation on the rivers of the Republic.

While the limits of the Argentine Republic are described only in the most general terms, those of Bolivia on the Peruvian side are defined according to the Peruvian view, and naturally the area of the country as determined by the authors does not accord with that of Sr. M. V. Ballivian. Of course the authors, being Peruvians, cannot be expected to recognise the claim of Bolivia to a frontier running up to the source of the Yavari, but the claim should have been stated.

The commerce and industry of Bolivia are thoroughly dealt with, and the means of transport are much better described than in the case of Argentina. The question of a port on the Paraguay should have been briefly noticed. Many interesting details are given on the cultivation of coca and the collection of india-rubber, and the education of the Indians is rightly insisted on as a means of improving their work.

If the work maintains the same standard throughout, it will be a valuable book of reference. It would be greatly improved by maps, however rough they might be, showing the localities where various crops are raised, mines, forests, etc. There is one of the Argentine Republic, but it is a general, not a commercial, map.

Bibliographie Géographique Annuelle, 1898. Publiée sous la direction de M. Raveneau. (*Annales de Géographie*, September 15th.) Paris: Armand Colin et Cie. Pp. 304.

The selection of geographical works made under the direction of Professor Raveneau has the advantage of being issued not long after the year to which it relates. The descriptive notes, written by a number of collaborators, seem to be quite as full as in previous issues, and are extremely useful.

Bibliotheca Geographica, herausgegeben von der Gesellschaft für Erdkunde zu Berlin. Bearbeitet von Otto Baschin. Band v., Jahrgang 1896. Berlin: W. H. Kuhl, 1899. Pp. xviii + 450.

The compilation and publication of this work has been a heavy burden on the funds of the Gesellschaft für Erdkunde, and the question of discontinuing the publication was being seriously considered, when the German Government, with its usual liberality towards scientific enterprise, relieved the Society of its difficulties by an annual grant. Consequently Dr. Otto Baschin has been able to make the present issue as complete as the former. The number of entries is 9400, about the same as in the previous year, and, as usual, the works catalogued embrace all sides of geography, and are carefully entered in their several places.

ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

REPORT OF COUNCIL.

Fifteenth Session, 1898-99.

The Council has the honour to submit the following Report :—

Membership.

The changes in the number of members have been as follows :—

Number on 1st November 1898,		1613
New members added,		91
		1704
Deduct by Deaths,	37	
„ Resignations,	67	
Struck off the roll (subscriptions in arrear),	8	
		112
Number remaining on 31st October 1899,		1592

This represents a net decrease of 21 members.

Of the present members, 908 are on the Edinburgh list, 300 are on the Glasgow list, and 115 and 101 are on the Dundee and Aberdeen lists respectively; in addition to these, 115 members reside in England and 53 reside abroad. Of the above, 251 are life-members.

Diplomas of Fellowship.

The Council conferred the Diploma of Fellowship (without fee) on Robert W. Felkin, M.D. They also conferred the Ordinary Diploma of Fellowship on the under-mentioned Members of the Society who had complied with the prescribed conditions, viz. :—Charles W. Donald, M.B., Andrew Houston, George Bickerton, Rev. Andrew J. Milne, M.A., LL.D., Andrew Coats, George Rattray, M.A. and David A. Hunter.

Finance.

The Council submits the annexed Financial Statement, which shows that the Funds have been increased during the Session by £41, 0s. 2d.

ABSTRACT OF THE ACCOUNTS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY

From 31st October 1898 to 31st October 1899.

FUNDS AT CLOSE OF LAST ACCOUNT:—			
£1000 Glasgow and South-Western Railway 4 per cent. Funded Debt, cost, 29th May 1885,		£1102 19 9	
£533, 6s. 8d. North British Railway 3 per cent. Consolidated Lien Stock, cost, 30th December 1890,		496 2 0	
£300 New Zealand Government 3½ per cent. Inscribed Stock, cost, 30th May 1894,		301 9 10	
		£1900 11 7	
BALANCES DUE BY BANK OF SCOTLAND:—			
On Deposit,	£200 0 0		
On Current Account (Edinburgh, £177, 8s. 10d.; Glasgow, £1, 1s.),	178 9 10		
		378 9 10	
Balance due by Secretary, £5, 17s. 11d. and by Honorary Treasurer, £34, 11s. 2d.,		40 9 1	
		£2319 10 6	
SUBSCRIPTIONS from Ordinary Members and New Members,	£1529 17 0		
FEES received for Society's Diploma,	10 10 0		
LECTURE TICKETS sold,	50 5 11		
MAGAZINES sold,	75 17 3		
DIVIDENDS and INTERESTS,	72 4 0		
		1738 14 2	
		£4058 4 8	

MAGAZINES, Printing, Paper, Lithographing, etc., from Nos. 9 to 12 of Vol. XIV., and Nos. 1 to 7 of Vol. XV., all inclusive, and for Postages, Delivery, etc.,		£662 5 10	
Less—Received during the year for Advertising,		60 0 0	
		£602 5 10	
GENERAL PRINTING,		33 5 0	
BOOKS and other Furnishings for Library,		63 17 3	
RENT OF HALLS, and other expenses of Lectures,		323 13 9	
RENT OF COUNCIL ROOM, Taxes, Gas, Repairs, Insurance, etc.,		126 9 0	
SALARIES:—			
To *Secretary*,	£200 0 0		
,, *Librarian and Clerks*,	282 0 0		
		482 0 0	
MISCELLANEOUS, including Stationery, General Expenses, Advertising, Cleaning, Postages, and General Expenses at Glasgow Branch,		66 3 2	
		£1697 14 0	
FUNDS AT CLOSE OF THIS ACCOUNT:			
£1000 Glasgow and South-Western Railway 4 per cent. Funded Debt, cost, 29th May 1885,	£1102 19 9		
£533, 6s. 8d. North British Railway 3 per cent. Consolidated Lien Stock, cost, 30th December 1890,	496 2 0		
£300 New Zealand Government 3½ per cent. Inscribed Stock, cost, 30th May 1894,	301 9 10		
£200 Great Central Railway Company 4½ per cent. Debenture Stock, cost, 31st December 1898,	312 2 9		
	£2212 14 4		
Balance on current account with Bank of Scotland, Edinburgh,	103 4 6		
Cash Balance in hands of Secretary, £1, 15s.; in hands of Honorary Treasurer, £42, 16s. 10d.,	44 11 10		
		2360 10	
		£4058 4 8	

Edinburgh, 13th November 1899.—I have examined the Accounts of the Royal Scottish Geographical Society, for the year ending 31st October 1899, of which the above is an Abstract, and compared them with the Vouchers and Instructions thereof, and find the same correct and sufficiently vouched.

HUGH BLAIR, C.A.

Meetings.

The Society held 21 meetings, of which 9 were in Edinburgh, 4 in Glasgow, 3 in Dundee and 5 in Aberdeen. These meetings were addressed by Mrs. Archibald Little, Mr. A. H. Savage Landor, Lieut. Meiklejohn of the Gordon Highlanders, Mr. W. S. Bruce, Mr. F. W. Christian, Mr. G. E. H. Barrett-Hamilton, Rev. Hugh Callan, Mr. Albert B. Lloyd, Mr. J. E. T. Ross Cormack, Mr. F. G. Jackson, and Colonel Bailey.

The Society's Magazine.

The *Scottish Geographical Magazine* has, as usual, been published monthly during the past session.

The Council takes this opportunity of acknowledging its obligations to contributors of articles, and to the following gentlemen who have rendered valuable assistance to the editors:—The Hon. J. Abercromby, J. G. Bartholomew, George Bickerton, Friedrich Bosse, H. M. Cadell, E. K. Carmichael, C. G. Cash, T. Craig-Brown, Dr. Th. Delius, Captain Hamilton Dunlop, Dr. Felkin, H. B. Finlay, Prof. P. Geddes, D. P. Heatley, S. Heatley, Dr. A. J. Herbertson, Prof. C. G. Knott, Dr. J. W. M'Crindle, D. MacRitchie, J. Mathieson, R. C. Mossman, J. R. Reid, Rev. G. M. Reith, Ralph Richardson, J. Y. Simpson, Dr. George Smith, C.I.E., Robert Smith, Prof. J. Arthur Thomson, Coutts Trotter, Colonel D. P. Trotter and W. B. Wilson.

Library and Map Department.

During the past session, 290 books and pamphlets, 17 atlases and 242 map-sheets have been added to the Library; and eight new exchanges have been arranged. The number of volumes borrowed by members was 2150. The Library is much resorted to by members and others who are in search of information. The expenses of the Library, including cost of binding, amounted to £63, 17s. 3d.

The Council desires to record its thanks to Foreign and Colonial Governments for the official publications presented to the Library, and also to private donors of books and maps, among whom may be mentioned:—Mrs. Hugh Rose, Mrs. N. H. Wilson, Monsieur A. Delebecque, Mr. M. A. B. Gilmour, M. G. Guyou, Mr. A. G. Nash, Mr. J. R. Reid, and Mr. Coutts Trotter. Its acknowledgments are also due to the Corresponding Members of the Society and others who have sent pamphlets, etc., to the Library, and to Mr. E. K. Carmichael, Mr. A. G. Nash, Mr. George Rattray, Mr. C. M. Woodford, and Major A. C. Yate for contributions to the Society's collection of photographs.

The Society's Rooms were closed during August for cleaning.

Antarctic Expedition Fund.

In October 1898 the Society issued a Special Antarctic Number of the *Scottish Geographical Magazine* containing an appeal from Sir John Murray in favour of the despatch of a National Antarctic Expedition; and, in response, the Council has received, or has been promised, the following subscriptions, viz.:—

Mr. Robert M'Vitie (through Sir John Murray),	£100	0	0
Mr. James Currie,	50	0	0
Anonymously given,	50	0	0
Mr. I. Julius Weinberg, Dundee,	25	0	0
Mr. J. G. Bartholomew,	10	0	0
Mr. Coutts Trotter,	10	0	0

The Council is ready to receive further subscriptions towards this important object, and trusts that a substantial proportion of the sum of £50,000 which is still required may be raised in Scotland.

Place-Names Committee.

The Place-Names Committee has been called together twice since January last to settle the spellings of place-names, and to select local representatives in different parts of the Highlands as referees with whom the Survey officers may consult. Some place-names were also discussed by correspondence among the Members of Committee.

The Society's Branches.

The Council has again the pleasure to acknowledge the services rendered by the Honorary Officials of the Branches of Glasgow, Dundee, and Aberdeen.

EOLOGICAL MAP
OF
AMAICA
SAWKINS, BROWN AND HILL
Scale of Miles
5
10
15
Browns Town
VALLEY
Port Antonio
BULL HEAD MTN
JOHN CROW PLATEAU
Rio Grande
Chapelton
Manchioneal
Portland Garden R.
S.E. Point
Bowden
Rio Minho
POTRT

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